TABLE 7. COLORADO - GRAND CANYON WATERSHED – 2002 ASSESSMENT – MONITORING DATA TABLE

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	PARAMETRIC USE SUPPORT	COMMENTS
	ADEQ TMDL Program Site 6 at mile marker 22.5 CMPAR007.95 101074	1999 - 4 suite 2000 - 6 suite, 1 metals	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4.3-9.1 (0%)	3 of 9		Naturally occurring low dissolved oxygen due to ground water upwelling. Not included in the final assessment.
			Turbidity NTU	10 (A&Wc)	6.2-441	8 of 10		Investigation shows that high turbidity is solely due to natural conditions.
	ADEQ TMDL Program Site 5 at mile marker 15 CMPAR013.79 101075	1999 - 4 suite 2000 - 6 suite, 1 metals	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4-10.7 (0%)	3 of 9		Naturally low dissolved oxygen near spring source. Not included in the final assessment.
			Turbidity NTU	10 (A&Wc)	6-441	8 of 10		Investigation shows that high turbidity is solely due to natural conditions.
	ADEQ TMDL Program Site 4 at mile marker 7.5 CMPAR022.37 101076	1999 - 4 suite 2000 - 6 suite, 1 metals	Arsenic µg/L	360 (A&Wc)	2-425	1 of 11		
			Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4.8-10.6 (0%)	6 of 10		Naturally occurring low dissolved oxygen due to ground water upwelling. Not included in the final assessment.
			Turbidity NTU	10 (A&Wc)	4.2-441	8 of 10		Investigation shows that high turbidity is solely due to natural conditions.
	ADEQ TMDL Program Site 3 below confluence CMPAR029.87 101077	1999 - 4 suite 2000 - 6 suite, 1 metals	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4.3-9.1 (0%)	3 of 9		Naturally occurring low dissolved oxygen due to ground water upwelling. Not included in the final assessment.
			Turbidity NTU	10 (A&Wc)	6.2-441	8 of 10		Investigation shows that high turbidity is solely due to natural conditions.
			pH SU	6.5-9.0 (A&Wc, FBC)	8/04-9.32	1 of 9		
	ADEQ TMDL Program Site 2 above Colorado River CMPAR029.90 101078	1999 - 4 suite 2000 - 6 suite, 1 metals	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	3.9-14.8 (0%)	3 of 10		Naturally occurring low dissolved oxygen due to ground water upwelling. Not included in the final assessment.
			Turbidity NTU	10 (A&Wc)	0.8-441	6 of 10		Investigation shows that high turbidity is solely due to natural conditions.
	ADEQ TMDL Program Site 1 Buckskin Gulch CMPAR030.00 101079	1999 - 4 suite 2000 - 6 suite, 1 metals	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.4-9.4 (0%)	1 of 10		Naturally occurring low dissolved oxygen due to ground water upwelling. Not included in the final assessment.
			Turbidity NTU	10 (A&Wc)	0.9-34	2 of 10		Investigation shows that high turbidity is solely due to natural conditions.

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	PARAMETRIC USE SUPPORT	COMMENTS
	Northern Arizona University Paria TMDL Monitoring Site 2 - 10 meters above Buckskin Site 3 - 10 meters below Buckskin Site 4 - 12.5 m below Buckskin G. Part of Seven sites along the Paria River and Buckskin Gulch,	1999 - 4 field, dissolved metals – each site 2000 - 6 field, dissolved metals - each site	Arsenic µg/L	50 (FBC)	<2.0 - 457.7	2 of 30		Metals data did not meet credible data requirements due to lapses in quality control/ protocols (testing after holding times expired). Naturally occurring low dissolved oxygen due to ground water upwelling, and naturally occurring turbidity due to sandstone geology. Data not used in final assessment.
			Beryllium µg/L	0.21 (FC) 4.0 (FBC)	<0.1 - 38.4	22 of 30 7 of 30		
			Dissolved oxygen mg/L	7.0 (A&Wc)	4.8 - 10.6	12 of 30		
			Turbidity NTU	10 (A&Wc)	0.8 - 441	21 of 30		
	Reach Summary Row A&Wc Attaining FC Attaining FBC Attaining	**1999-2000** **77 samples** **11 sampling events**	**Arsenic µg/L**	**360 (A&Wc)**	**2-458**	**1 of 77**	**Attaining**	**ADEQ's TMDL Program collected samples at 7 sites. Reach assessed as "attaining all uses."**
			pH SU	**6.5-9.0 (A&Wc, FBC)**	**8/04-9.32**	**1 of 70**	**Attaining**	
Pumpkin Springs At Colorado River AZ15010002-SP01 A&Ww, FC, FBC, DWS, Agl, AgL	National Park Service Routine Monitoring Above Colorado River CMSPR3	1998 - 1 field	OK					National Park Service data did not meet new "credible data" requirements and was not used for this assessment.
	Reach Summary Row						**Not assessed**	**Insufficient credible data.**
Royal Arch Creek headwaters-Colorado River AZ15010002-871 A&Wc, FC, FBC	National Park Service Routine monitoring Above Colorado River CMRYA000.23	1996 - 2 field 1997 - 1 field 1998 - 1 field 1999 - 1 field	Selenium (total) µg/L	20	5-25	1 of 7		High seleniumis naturally occurring from a spring source. National Park Service data did not meet new "credible data" requirements and was not used for this assessment.
	Reach Summary Row						**Not assessed**	**Insufficient credible data.**
Saddle Canyon Creek headwaters-Colorado River AZ15010002-703 A&Wc, FC, FBC	National Park Service Routine Monitoring Near Tapeats, below falls CMSAD000.16	1996 - 1 field 1997 - 1 field 1998 - 1 field 1999 - 1 field	OK					National Park Service data did not meet new "credible data" requirements and was not used for this assessment.
	Reach Summary Row						**Not assessed**	**Insufficient credible data.**
Shinumo Creek headwaters-Colorado River AZ15010002-029 A&Wc, FC, FBC	National Park Service Routine Monitoring Colorado River, @ Trail crossing CMSHI000.06	1996– 1 field 1997 - 1 field 1998 - 1 field	OK					National Park Service data did not meet new "credible data" requirements and was not used for this assessment.
	Reach Summary Row						**Not assessed**	**Insufficient credible data.**

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	PARAMETRIC USE SUPPORT	COMMENTS
Spring Canyon Creek headwaters-Colorado River AZ15010002-318 A&Wc, FC, FBC	National Park Service Routine monitoring Above Colorado River CMSPG000.24	1996 - 1 field 1997 - 1 field 1998 - 1 field 1999 - 1 field	OK					National Park Service data did not meet new "credible data" requirements and was not used for this assessment.
	Reach Summary Row						Not assessed	Insufficient credible data.
Stone Creek headwaters-Colorado River AZ15010002-030 A&Wc, FC, FBC	National Park Service Routine Monitoring At Colorado River, below falls CMSTO000.14	1997 - 1 field	OK					National Park Service data did not meet new "credible data" requirements and was not used for this assessment.
	Reach Summary Row						Not assessed	Insufficient credible data.
Tapeats Creek headwaters-Colorado River AZ15010002-696 A&Wc, FC, FBC	National Park Service Routine monitoring Above Colorado River CMTAP000.24	1996 - 1 field 1998 - 1 field	OK					National Park Service data did not meet new "credible data" requirements and was not used for this assessment.
	Reach Summary Row						Not assessed	Insufficient credible data.
Three Springs Creek headwaters-Colorado River AZ15010002-1180 A&Wc, FC, FBC, DWS, AgI, AgL	National Park Service Routine monitoring Above Colorado River CMTHS000.04	1996 - 1 field 1997 - 1 field 1998 - 1 field	OK					National Park Service data did not meet new "credible data" requirements and was not used for this assessment..
	Reach Summary Row						Not assessed	Insufficient credible data.
Thunder River headwaters-Tapeats Creek AZ15010002-732 A&Wc, FC, FBC	National Park Service Routine Monitoring Below Cave, @ Tapeats CMTHR000.38	1999 - 1 field	OK					National Park Service data did not meet new "credible data" requirements and was not used for this assessment.
	Reach Summary Row						Not assessed	Insufficient credible data.
Vasey's Paradise (Spring) At Colorado River AZ15010001-SP01 A&Wc, FC, FBC	National Park Service Routine Monitoring Below Spring CMSPR1	1996 - 2 field 1997 - 1 field 1998 - 1 field 1999 - 1 field	OK					National Park Service data did not meet new "credible data" requirements and was not used for this assessment.
	Reach Summary Row						Not assessed	Insufficient credible data.

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	PARAMETRIC USE SUPPORT	COMMENTS
Virgin River Beaver Dam Wash-Big Bend W. AZ15010010-003 A&Ww, FC, FBC, AgI, AgL	USGS Station # 9415000 At Littlefield, Az CMVGR010.18	1996 - 5 suite 1997 - 6 suite 1998 - 6 suite 1999 - 6 suite Missing total mercury, arsenic, beryllium manganese, boron, and copper.	Fecal coliform CFU/100/ml	4000 (A&Ww, AgI, AgL)	19-240,000	2 of 15		1 in 1996 and 1 in 1998
			Escherichia coli CFU/100/ml	580 at single sample max. (FBC)	12-3000	1 of 5		1 in1999, not sampled for in 1996-1998.
			Turbidity NTU	50 (A&Ww)	0.3-360	8 of 23		According to the National Park service turbidity may be naturally occurring due to sandstone formations.
	Reach Summary Row A&Ww Impaired FC Inconclusive FBC Inconclusive AgI Impaired AgL Impaired	**1996-1999** **23 samples** **Missing core parameters**	**Escherichia coli CFU/100/ml**	**580 at single sample max. (FBC)**	**12-3000**	**1 of 5**	**Inconclusive**	**US Geological Service collected 23 samples in 1996-1999. Reach assessed as impaired due to turbidity and bacteria. Reach put on Planning List due to missing core parameters.**
			Fecal coliform CFU/100 ml	**4000 (A&Ww, AgI, AgL)**	**19-240,000**	**2 of 15 2 in 3-years**	**Impaired**	
			Turbidity NTU	**50 (A&Ww)**	**0.3-360**	**8 of 23**	**Impaired**	
LAKES MONITORING DATA								
Lake Powell AZL14070006-1130 A&Wc, FC, FBC, DWS, AgI, AgL	Bureau of Rec. Selenium Investigation 4 sites CMPOW	1996 - 4 selenium 1997 - 1 selenium 1998 - 3 selenium 1999 - 3 selenium	OK					Exceeds chronic selenium standard occasionally (12 of 49 samples). Insufficient data to assess with chronic criteria. (Chronic standard requires 4 consecutive days of samples.)
	Glen Canyon Natl. Rec. Area Bact Monitoring Network CMPOW - AP2	1995 - 17 bact 1996 - 16 bact 1997 - 9 bact 1998 - 10 bact	OK					
	Glen Canyon Natl. Rec. Area Bact Monitoring Network CMPOW - NPS1	1996 - 12 bact	OK					
	Glen Canyon Natl. Rec. Area Bact Monitoring Network CMPOW - STATE1	1996 - 12 bact 1997 - 8 bact 1998 - 10 bact 1999 - 8 bact	OK					
	Glen Canyon Natl. Rec. Area Bact Monitoring Network CMPOW - WWB1	1996 - 16 bact 1997 - 10 bact 1998 - 10 bact 1 1999 - 10 bact	OK					
	Glen Canyon Natl. Rec. Area Bact Monitoring Network CMPOW - WWM1	1998 - 10 bact 1999 - 10 bact	OK					
	Glen Canyon Natl. Rec. Area Bact Monitoring Network CMPOW - WWPB1	1996 - 27 bact 1997 - 9 bact 1998 - 10 bact 1999 - 8 bact	OK					

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	PARAMETRIC USE SUPPORT	COMMENTS
	Glen Canyon Natl. Rec. Area Bact Monitoring Network CMPOW - WWPB2	1996 - 9 bact	OK					
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive AgI Inconclusive AgL Inconclusive	1996-1997 68 sampling events Missing core parameters.	OK				Inconclusive	Bureau of Recreation and Glen Canyon Natural Recreation Area collected a total of 68 samples at 11 sites on Lake Powell in Arizona. Insufficient core parameters monitored to assess uses.

Information for interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from using AZ (for streams) or AZL (for lakes) + Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses", "Agency", and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" – This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" – The year and number of water samples is shown. The federal "water year is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
  - "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among samples as many different programs and agencies provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
  - "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
  - If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters
- "Standards Exceeded at this Site per Sampling Event."
  - Although many parameters may be analyzed, only those exceeding a standard are shown.
  - "OK" indicates that no standards were exceeded.
  - The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
  - "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
  - A mean or geometric mean will be shown along with the range of results if applicable to the standard.
- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or " Inconclusive." See assessment criteria in Chapter III of Volume 1.

Ground Waters Assessments in the Colorado-Grand Canyon Watershed

Major ground water stressors – Monitoring data collected from wells in this watershed between October 1995-October 2000 are summarized in **Table 8** and illustrated in **Figure 12, 13, and 14.** As **Table 8** indicates, wells are sampled for different constituents.

As illustrated in **Figure 12** most of the wells sampled were part of two ADEQ ground water studies: the Virgin River Basin (1999) and the Hualapai Valley Basin (2001). These studies are discussed later in this Section. Note that radiochemical and metals were exceeded in both study areas, while nitrate and fluoride were exceeded only in the Hualapai Valley.

TDS concentration – Water quality can be characterized based on concentration of Total Dissolved Solids (TDS). High levels of salinity limits the practical uses of ground water in some areas of this watershed as TDS over 500 mg/L has an off-flavor (60% of the wells tested) and TDS over 1000 mg/L will limit its use for some crops (33% of the wells tested).

As illustrated in **Figure 13 and Table 8**, TDS is elevated in both ground water basins monitored. There appears to be a cluster of wells along the Virgin River with elevated salinity. The elevated levels of TDS do not present a human-health concern for drinking water use. The TDS concentration is only being used to generally characterize water quality.

Although no TDS ground water quality standard has been established in this watershed, a flow-weighted average annual salinity surface water standard is established on the Colorado River below Hoover Dam, below Parker Dam, and at Imperial Dam, just downstream of this watershed. These standards were established by Arizona as part of the federally administered Colorado River Basin Salinity Control Program, and these standards are being met. More information about the Colorado River Basin Salinity Control Program is provided in Section III of this report.

Nitrate concentrations – Water quality can also be characterized by looking at the concentration of nitrates in ground water (**Figure 14**). Naturally occurring nitrate concentrations in ground water are generally below 3 mg/L. Concentrations above 5 mg/L indicate potential anthropogenic sources of nitrate. Of the 192 wells monitored for nitrate, 15% exceeded this 5 mg/L concentration.

When nitrate concentrations exceed 10 mg/L, Arizona's Aquifer Water Quality Standard has been exceeded. This standard was set to protect human health , as water with nitrate greater than 10 mg/L may present a health problem for babies and should not be consumed by nursing mothers. Only 2 of the 75 wells monitored (3%) exceeded 10 mg/L. Some monitored wells are irrigation wells (not used for drinking water); therefore, even these two wells may not represent a human-health concern. However, efforts need to continue to minimize further contamination of ground water by nitrate.

Table 8. Colorado-Grand Canyon Watershed Ground Water Monitoring 1996 - 2000

MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	35		6	17%
	Fluoride	60		2	3%
	Metals/Metaloids	60		7	12%
	Nitrate	60		2	3%
	VOCs + SVOCs*	21	1	0	0%
	Pesticides	21	0	0	0%
TARGETED MONITORING WELLS	Radiochemicals	4		0	0%
	Fluoride	13		0	0%
	Metals/metaloids	14		0	0%
	Nitrate	15		0	0%
	VOCs + SVOCs*	0	—	--	--
	Pesticides	0	—	--	--

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
64	26	17	20	1

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
75	64	9	2

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.
*The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.

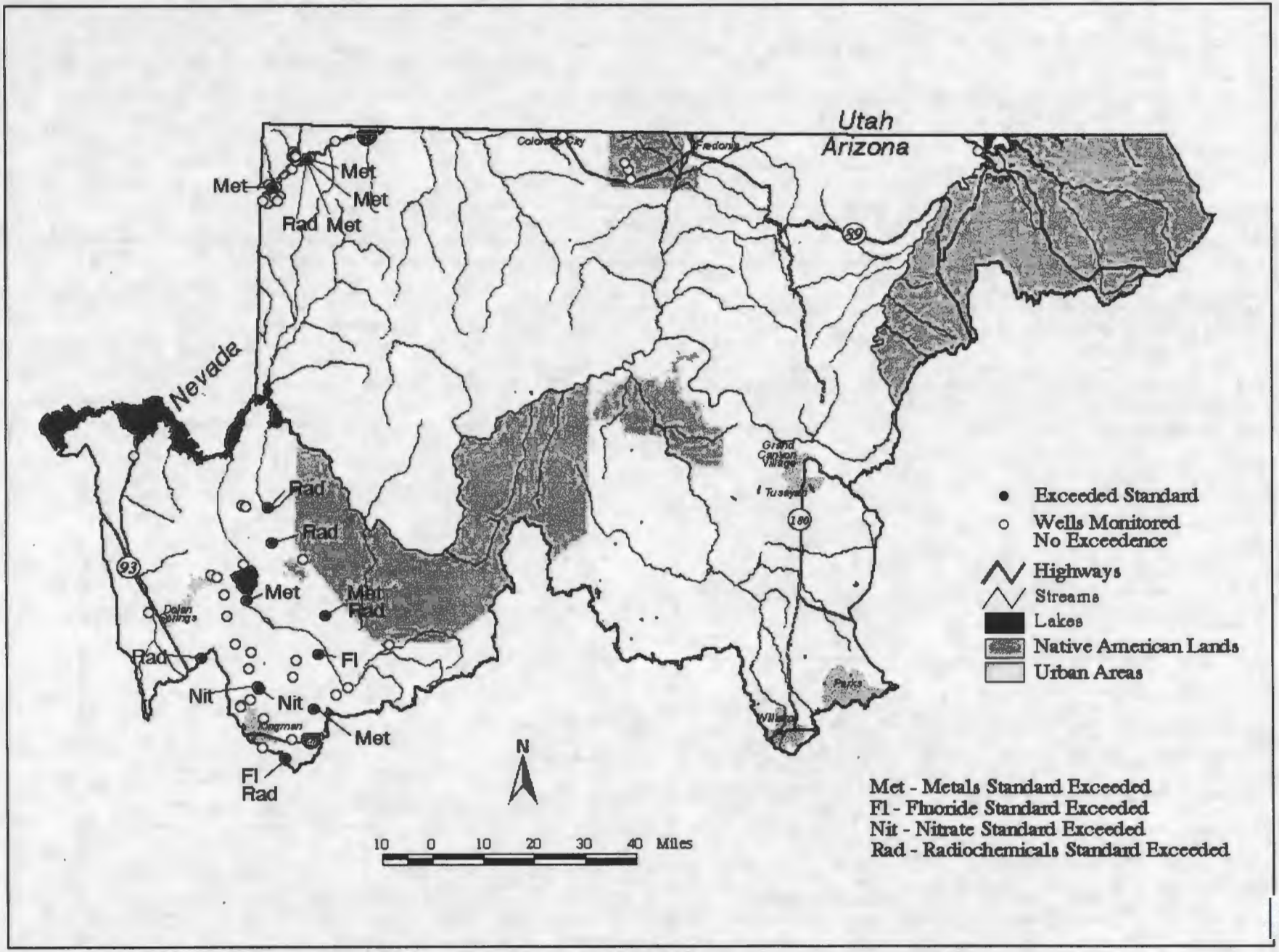

Figure 12. Ground Water Monitoring in the Colorado-Grand Canyon – 1996-2000

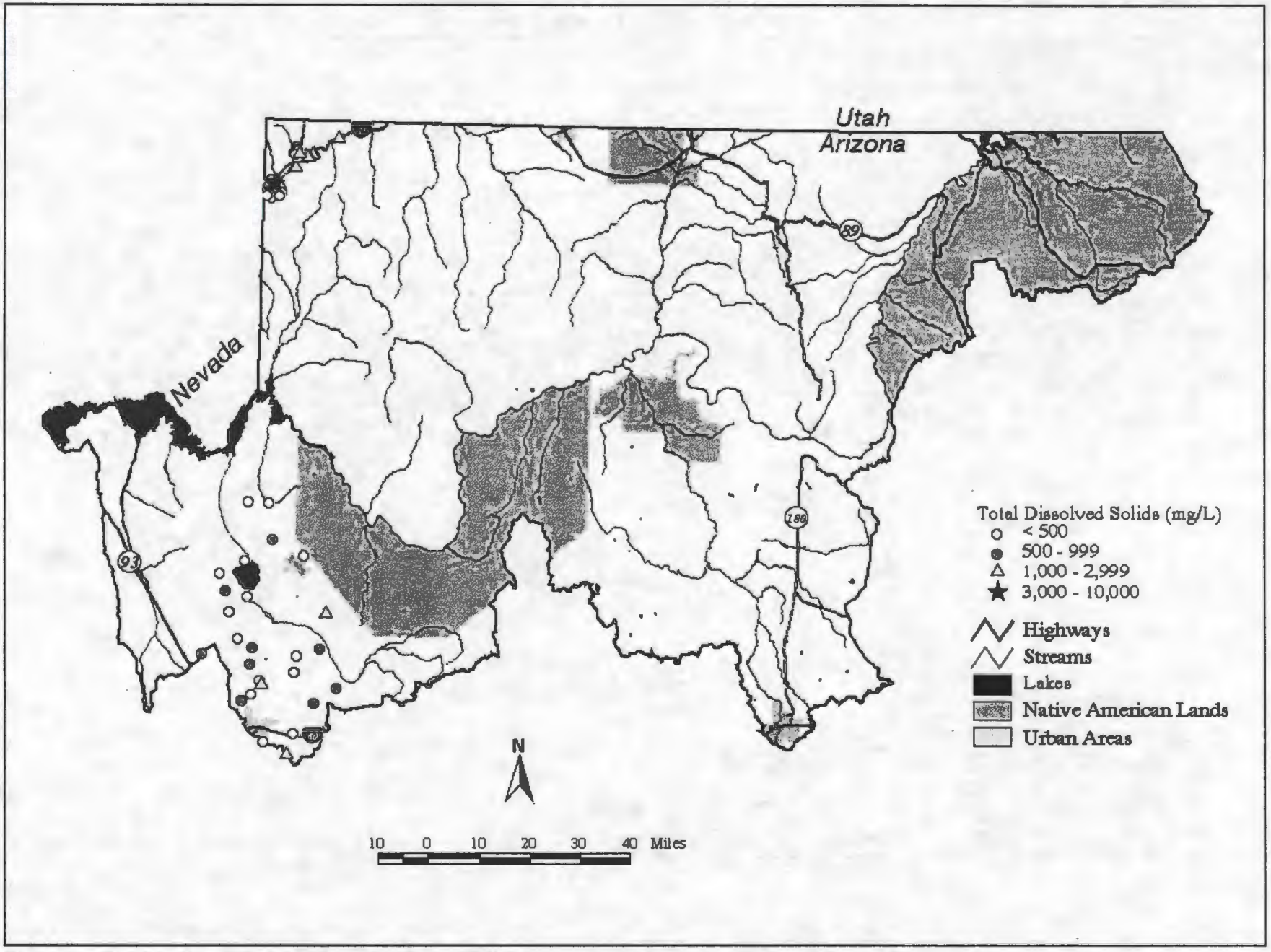

Figure 13. Classification of Ground Water Quality by TDS Concentration in the Colorado-Grand Canyon Watershed

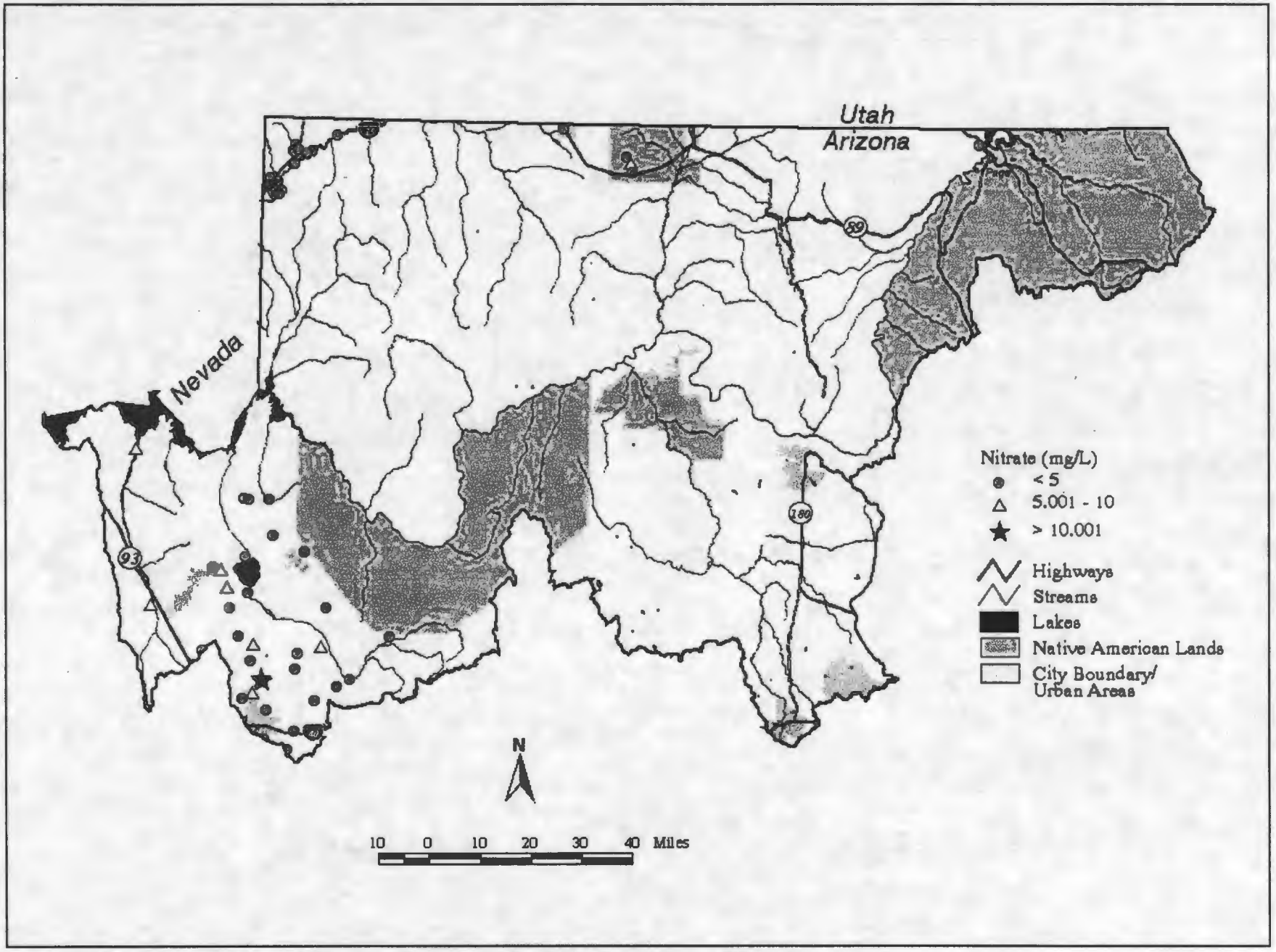

Figure 14. Classification of Ground Water by Nitrate in the Colorado-Grand Canyon Watershed

Watershed Studies and Alternative Solutions in the Colorado-Grand Canyon Watershed

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the Colorado-Grand Canyon Watershed. Watershed partnerships active in this watershed are also cited.

Surface Water Studies and Mitigation Projects

Total Maximum Daily Load Studies – The following TMDL analyses have been completed or are ongoing in this watershed. Further information about the status of these investigations can be obtained by contacting the TMDL Program manager at (602) 207-4468 or at ADEQ's web site: http://www.adeq.state.az.us/environ/waters/assess.

- Paria River TMDL – In 1998, the Paria River was identified as impaired due to turbidity and beryllium, and subsequently included on the 303(d) List of impaired waters. The segment of concern is a 29 mile stretch from the Utah border to the Colorado River at Lee's Ferry. In October 1998, ADEQ developed a cooperative water quality monitoring effort with the Bureau of Land Management, and Northern Arizona University.

  Eighty-five percent of the verification samples exceeded the applicable turbidity standard; however, this turbidity is due to a naturally high sediment load generated by the sandstone geology. Further, management practices are in place to minimize potential sources of sediment within the canyon.

  The verification monitoring indicated no exceedances for beryllium. Based on this study, ADEQ is proposing to delist turbidity and beryllium. This would remove the Paria River from the 303(d) List of impaired waters.

Water Quality Improvement Grant Projects – ADEQ has awarded the following Water Quality Improvement (319h) Grants for projects in this watershed:

- The Greater Kingman Wildcat Dump Cleanup Project – This project is attempting to reduce wildcat dumping through education and outreach, and to cleanup eighteen wildcat dump sites in the Kingman area because of ground water contamination concerns.

  This project was initiated on August 1, 2000, and has conducted workshops, created educational materials, solicited community participation, identified dump sites, and initiated the cleanup. An educational video and brochures have been developed. Brochures are distributed after the video presentations and target the hazards of illegal dumplings.

  For more information regarding this project contact: Elno Roundy, Chairman, Northwest Arizona Watershed Council, P.O. Box 3222, Kingman, Arizona 86434.

- Abatement of Non-point Source Pollution at Spencer Beach on the Hualapai Reservation – Spencer Beach is located on the south side of the Colorado River at river mile 246, at the confluence of Spencer Creek with the Colorado River. It is a popular beach used for camping and picnicking by Colorado River rafters and power boaters from Lake Meade. However, this area lacked adequate sanitary human-waste facilities and trash facilities, which raised concerns that the beach and adjacent river water may become contaminated by fecal coliform and polluted with trash.

  The project provided a new a composting restroom at the beach in 2000. The existing human waste buried in the beach sand was collected and removed during February 1999. The facility restroom was completed on April 29, 2000. Currently the restroom is reportedly receiving considerable use and the beach appears to remaining free from noticeable trash. The Hualapai tribe is conducting bacterial monitoring at the beach to determine the effectiveness of these measures.

  For more information regarding this project contact: Dr. Kerry Christiansen, Senior Scientist, Hualapai Department of Natural Resources, P.O. Box 300, Peach Springs, AZ 86434

- Milkweed Springs Sediment Control and Riparian Enhancement Project –Milkweed Springs is located along the headwaters of Spencer Creek (which discharges to the Colorado River), on the Hualapai Indian Reservation in northwestern Arizona. In this project structural sediment control measures were installed to minimize sediment due to discharges in the watershed and unpaved roads upstream of Milkweed Springs.

  Check dams and filter dams were constructed in critical areas between a constructed gravel road and the riparian area associated with Milkweed Springs and Spencer Creek. During construction, prior to completion of all of the structures, flash flooding knocked out the temporary structures (which were designed to fail in very high flows) and washed away a front end loader belonging to the tribe. The project was finished and the washed out structures rebuilt in 2000. The structures are in place and functioning except for one temporary structure which had partial failure. Areas denuded during road construction were also restored by mulching and reseeding to reduce sediment discharge.

  Implementation effectiveness has been measured quarterly through:

  - Photo points to document visual changes,
  - Flow rate and basic water quality measurements,
  - Measurement of sediment trapped behind rock check dams.

  More check and filter dams may be needed in the upper watershed, along with improvements in grazing management, to control sedimentation. This project was scheduled for completion in 2001. For more information regarding this project contact: Don Bay, Contracting Officer, Hualapai Department of Natural Resources, P.O. Box 300, Peach Springs, Arizona 86001

- Elimination or Reduction of Impairment to Red Springs, Moss Springs, and the Colorado River in Mohawk Canyon – The Hualapai Indian Reservation was awarded a grant to improve and maintain surface water quality impaired by elevated fecal coliform and sediment levels in the Mohawk Canyon drainage area through the removal of feral horses. The canyon covers 620 square miles in northwestern Arizona.

  Fifty-two feral horses have been removed from Mohawk Canyon by helicopter net-gun capture and two fences have been added to keep horses from reentering the canyon; however, some wild horses remain in the canyon. These horses could have been missed during the roundup or gained reentry into the Canyon because the new fence at upper end of Mohawk Canyon was reportedly washed out. The Hualapai tribe intends to rebuild the damaged fence (at their expense).

  Project administrators expect nearly 100% reduction of pollutants following the completion of this project. The Hualapai tribe is to measure the effectiveness of the project through photopoint documentation and water quality sampling to compare conditions before and after this animal removal project.

  The completion of this project was scheduled for 2001. For more information regarding this project contact: Don Bay, Contracting Officer, Hualapai Department of Natural Resources, P.O. Box 300, Peach Springs, Arizona 86001.

Water Protection Fund Projects – Arizona Department of Water Resources provided Water Protection funds for the following projects.

- Protection of Spring and Seep Resources of the South Rim, Grand Canyon National Park by Measuring Water Quality, Flow, and Associated Biota – The Grand Canyon National Park received funds to make a hydrologic and biologic assessment (water quality, spring flora, and associated invertebrate fauna inventory) of twelve seeps and springs on the south rim of the Grand Canyon National Park. This assessment and a public outreach effort will be used to develop management objectives and strategies.

- Glen and Grand Canyon Riparian Restoration Project – The Grand Canyon Wildlands Council received a grant to:
  - Restore 10 acres of native cottonwood-willow habitat along the Colorado River at Lee's Ferry and
  - Eradicate tamarisk from 63 tributaries in the Grand Canyon.

Colorado River Basin Salinity Control Program – See earlier discussion of research in the opening section of Volume II.

Human Waste Monitoring of Lake Powell – Glen Canyon National Recreation Area has historically had a problem with fecal material being deposited on and buried in the sandy beaches of Lake Powell. Not only is waste on the beaches unsightly, fecal material may contain pathogens. Because of these concerns Glen Canyon national Recreation Area enacted a rule that requires campers within 1/4 mile of Lake Powell to have and use a device for containing solid human waste unless toilets are available on the beach.

In 1999, six sites were selected to monitor for human waste and determine the effectiveness of the rule (Munill, et al, 2001). Human wastes were counted and cleaned from sites at Romana Cove, Crosby Canyon, Hansen Creek, Moqui Canyon and Warm Creek Beach in Utah. After two years, more waste was being collected than in prior seasons. This may be due to the crew being more adept at locating the wastes.

Selenium Budgets for Lake Powell and the Upper Colorado River Basin – Selenium is a constituent of concern in water in the Colorado River Basin. Since the discovery in 1983 of wildlife deaths and deformities caused by selenium in irrigation drain water in Kesterson National Wildlife Refuge in California, the Department of Interior has investigated the quality of irrigation drain water from 26 projects in western United States. This research has identified the following conditions that individually or in combination may influence concentrations of selenium in irrigation drain water:

- A geologic source of selenium;
- Low rainfall and high evaporation; and
- Topographically closed areas (e.g., impoundments, backwaters).

The purpose of this study (Engberg, 1999) was to determine selenium sources above Lake Powell and selenium mobilization processes in effect.

Based on data collected by the Bureau of Reclamation between 1985-1994, 83% of the selenium entering Lake Powell is accounted for at the output site (flows through the lake). The rest may be incorporated by the lake sediment or used by the biota. Of the selenium that reaches Lake Powell, the Gunnison River Basin produces an estimated 31% and the Grand Valley in Colorado produces an estimated 30%. Irrigation related activities are thought to be responsible for mobilizing 71% of the selenium that reaches Lake Powell.

Selenium concentrations in water at Imperial Dam of the Colorado River upstream of the Mexico international border are similar to those at the output site of Lake Powell. Therefore, most selenium observed in downstream areas of the Colorado River probably are probably derived from the Colorado River watershed above Lake Powell.

Bacterial Monitoring of Lake Mead – The National Park Service collects water quality samples from four coves on Lake Mead in Nevada that get high recreational uses (Boxcar Cover, Sandy Cove, James Bay, and Middle Point). In addition, a sample is collected from Teakettle Cove, a low use cove in Nevada. Samples are analyzed for fecal coliform and *Enterococcus*.

Limnological Investigations of Lake Mead – The US Bureau of Reclamation has been conducted limnological investigations at the Boulder Basin of Lake Mead from 1990 - 1998. The purpose of these investigations were to:

- Collect water quality data that might indicate impacts of the wastewater and other drainage flowing to the Las Vegas Bay from Las Vegas Wash in Nevada;
- Characterize limnological conditions that might affect the quality of water as a public drinking water source;
- Develop new technologies for assessing limnological features of a reservoir relating to water quality; and
- Improve the general understanding of Lake Mead's ecology and its relationship to Colorado River systems (as the Colorado River flows through this large reservoir).

The report concluded that there are summertime oxygen sags due to decomposition of organic material, when *Chlorophyll a* and algae are at peak levels. Storm water runoff negatively impacts Boulder Basin as all parameters evaluated were elevated. No standards were exceeded.

Las Vegas Wash - Lake Mead Water Quality Standards Study – The Nevada Division of Environmental Protection completed a water quality standards study for Las Vegas Wash and Lake Mead in 1998. The study proposed to establish control points along Las Vegas Wash and in Las Vegas Bay in Lake Mead. It also proposed to add aquatic life standards (excluding fish) to the wash and eventually protect Las Vegas Bay for fishing and swimming. Some of the proposed changes included:

- Change pH from 7.0 - 9.0 to 6.5 - 9.0 Standard Units;
- Replace Total Filterable Residue with Total Dissolved Solids;
- Decrease the nitrate standard from 10 mg/L to 5 mg/L;
- Add *Escherichia coli* standards of: 235/100 ml (single sample maximum) and 126/100 ml (30-day geometric mean).

Ground Water Studies and Mitigation Projects

Virgin River Basin Study– The Virgin River Groundwater Basin, located in the northwestern corner of Arizona, encompasses more than 430 square miles. ADEQ conducted a regional study of the this basin in 1997. The Virgin River is a free-flowing major tributary of the Colorado River from its headwaters in Utah to Lake Mead in Nevada. It is characterized by high turbidity and salinity. The Virgin River's largest tributary in Arizona is Beaver Dam Wash, which is perennial for approximately one mile above its juncture with the Virgin. Ground water is the primary source for municipal, domestic, and livestock uses; however surface water is also used for irrigation. Four aquifers were examined in this study. Each aquifer sampled has a unique ground water composition which appears to be related to hydrological and geologic conditions within the basin.

- Beaver Dam Wash Aquifer – This aquifer consists of unconsolidated silt, sand, and gravel deposited between steep terraces created by the incision of Beaver Dam Wash. The relatively low parameter concentrations characteristic of the Beaver Dam Wash Aquifer are likely related to the high quality surface water in Beaver Dam Wash.
- Littlefield Aquifer – This aquifer is located below the town of Littlefield, and is comprised of alluvial-fan deposits that rest on a limestone formation. This horizontal limestone unit is overlain by alluvial fan deposits and is the likely cause of this saline and very hard ground water.
- Virgin River Alluvial Aquifer -- This aquifer consists of the flood plain and terrace alluvium southwest of Littlefield, along the Virgin River. The relatively high parameter concentrations characteristic of the Virgin River Alluvium Aquifer are likely influenced by the saline surface flow of the Virgin River. Factors influencing the Virgin River salinity include an initial high salt concentration, saline spring discharges near the community of Littlefield, and irrigation return flows.
- Virgin River Basin Aquifer – This aquifer is composed of the alluvial fan deposits of the Virgin Mountains south of the Virgin River. It exhibits a mixed chemistry. In contrast to other aquifers, the relatively low parameter concentrations characteristic of the Virgin River Basin Aquifer are likely the result of high quality, recharge from the Virgin Mountains.

Interpretation of these results suggest that ground water in the Virgin River Groundwater Basin supports drinking water uses as only one well exceeded an state aquifer water quality standard. However residents (particularly those utilizing the Littlefield Aquifer or the Virgin River Alluvial Aquifer) may prefer to install water treatment units for domestic use or to obtain domestic water from alternative sources for aesthetic reasons as 25 of the 38 wells sampled (66%) exceeded aesthetic-based criteria. Nitrate, with a few exceptions, was found at levels indicating minimal impact from human activities. These findings suggest that for domestic or municipal use, relatively shallow wells should be used in the Beaver Dam area while deeper wells should be used near the Virgin River.

Ground water Reconnaissance Survey in Mohave County: The watersheds (Sacramento Valley, Big Sandy Valley, Detrital Valley and Hualapi Valley) are all to the south of the Colorado River.

The University of Arizona has been commissioned by the Northwest Arizona Watershed Council (under the Arizona Rural Watershed Initiative) to catalogue the water resources of Mohave County in the Sacramento Valley, Hualapai Valley, Big Sandy Valley, and Detrital ground water basins. This research has two key components:

- To collect all relevant hydrologic data and information into one single source that can then be used by anyone doing any research or contractual work in the region in the future. This includes but is not limited to; Previous estimates of aquifer size, all publicly available studies, Depth to water, drawdown, rainfall measurements, recharge estimates and soil maps.

- To provide a preliminary hydrologic assessment based on the information obtained. This includes an assessment of earlier work to compare and attempt to explain why different aquifer parameters were used by different studies to come up with different figures.

Although this project is Phase I of a multi-phase project, it is anticipated that the result of this study will minimize data collection for others working in Mohave County (e.g., universities, government agencies, or private companies).

For more information contact: Gavin Fielding, Researcher, School of Renewable Natural Resources, 325 BioSciences East, University of Arizona, Tucson , AZ 85721 (gavinfielding@lycos.com) or (520) 621-5211 (for messages only). Fax: (520) 621-8801

Watershed Partnerships

Northwest Arizona Watershed Advisory Council – This council has been supported by the US Bureau of Land Management, and has identified the following key issues: wildcat dumping, ground water protection, and enforcement of existing environmental laws and regulations. This council has been responsible for the cleanup of two wildcat dump sites and is in the process of cleaning up two more sites. For information about group meetings, contact Elno Roundy (cleo@ctax.com).

Lake Mead Water Quality Forum – The Nevada Division of Environmental Protection established this public forum for discussion of water quality related issues pertaining to Las Vegas Wash (Nevada) and Lake Mead. The Forum identified the critical water quality issues facing Lake Mead. In priority order, the issues are:

- Identification of contaminant sources;
- Define the plume;
- Establish Forum water quality goals;
- Determine wether recreation involving water contact is safe in Las Vegas Bay near the inlet of the wash;
- Determine whether fish consumption advisories needs to issue;
- Sediment loading to Las Vegas and its bay;
- Further characterization of wastewater flows and posting of advisories;
- Identification of contaminants which are responsible for endocrine disruption observed in carp.

The Forum supported the National Park Service in posting signs advising that swimming was not recommended in Las Vegas Wash (Nevada).

The Forum has established a centralized database of water chemistry data, assisted in the collection and analysis of sport fish, and acted as an educational resource to the public.

Lake Powell Memorandum of Understanding Group and its Technical Advisory Committee – In 1998, a Memorandum of Understanding among the National Park Service, the US Geological Survey, the US Bureau of Reclamation, the US Fish and Wildlife Service, the US Environmental Protection Agency, Utah Division of Water Quality, Utah Division of Wildlife Resources, Arizona Game and Fish Department and Arizona Department of Environmental Quality was established to provide a mechanism for coordinating programs and initiatives that relate to the protection and understanding of Lake Powell.

For information concerning meetings of the Technical Advisory Committee, contact Mark Anderson at mark_anderson@nps.gov or (928) 608-6377.

Colorado-Lower Gila Watershed

COLORADO-LOWER GILA WATERSHED CHARACTERISTICS						
SIZE	14,459 square miles (13% of the State's land area).					
POPULATION BASE	Approximately 285,500 people live in this watershed (estimated from the 2000 census). This is about 5% of the state's population.					
LAND OWNERSHIP **(Figure 15)**	Bureau of Land Management	33%	Military reservations	25%	Other state and federal land	17%
	National Wildlife Refuge	14%	State Land Dept.	6%	Tribal land	4%
	Private	<1%				
LAND USES AND PERMITS **(Figure 16)**	Major communities in this watershed include: Yuma, Bullhead City, and Lake Havasu City. Tribal and private land along the lower Colorado River and lower Gila River is intensively cultivated. Open grazing occurs across the watershed. This watershed contains major military ranges with live fire exercise areas (bombing ranges). Six wildlife refuges and three wilderness areas have been established in this watershed. Land uses within these designated areas are restricted (i.e., mineral lease and mineral entry withdrawn and motorized travel prohibited); however, grazing still occurs on most of these lands.					
HYDROLOGY AND GEOLOGY	This watershed is defined by the Colorado River drainage area within Arizona below Lake Mead to the border with Mexico, excluding the Bill Williams River and the Gila River above Painted Rocks dam. Perennial water is primarily limited to the main stem of the Colorado River, with irrigation return flow providing perennial flow in the Gila River near its confluence with the Colorado River (Brown et al. 1978). Above Imperial Dam diversions, the flow on the Colorado River has varied between a minimum of 1,450 cfs to a maximum of 40,800 cfs since Hoover Dam was constructed in 1935 (USGS 1996). Several ground water basins are included in this large watershed, including: Butler Valley, Hualapai Valley, Lower Gila, Lake Havasu, Lake Mohave, Parker, Ranegras Plain, Sacramento Valley and Yuma basins, with a small portion of the Harquahala basin. Ground water in valleys is typically found in unconfined high yield aquifers consisting of basin-fill sediments, alluvial sands, and gravel. Confined aquifers are often found in Bouse formations and fanglomerate units (ADWR 1994). This watershed is within the Basin and Range Hydrologic Province, which is characterized by fault-block desert mountains with broad valleys and basins. Elevations in the watershed range from 80 feet above sea level where the Colorado River enters Mexico to 5456 feet above sea level in the Black Mountains near Lake Mohave.					
UNIQUE WATERS	None					
ECOREGIONS	Southern Basin and Range.					
OTHER STATES, NATIONS, TRIBES	This watershed receives drainage from the Colorado River, the Bill Williams River, and the Gila River. At Yuma, the Colorado River receives drainage from Utah, Colorado, Wyoming, New Mexico, Nevada, California, and Arizona. Fort Mohave, Fort Yuma, Cocopah, and Colorado River tribal lands occur within this watershed. Although these lands occupy only 4% of the land, they are primarily adjacent to the Colorado River.					

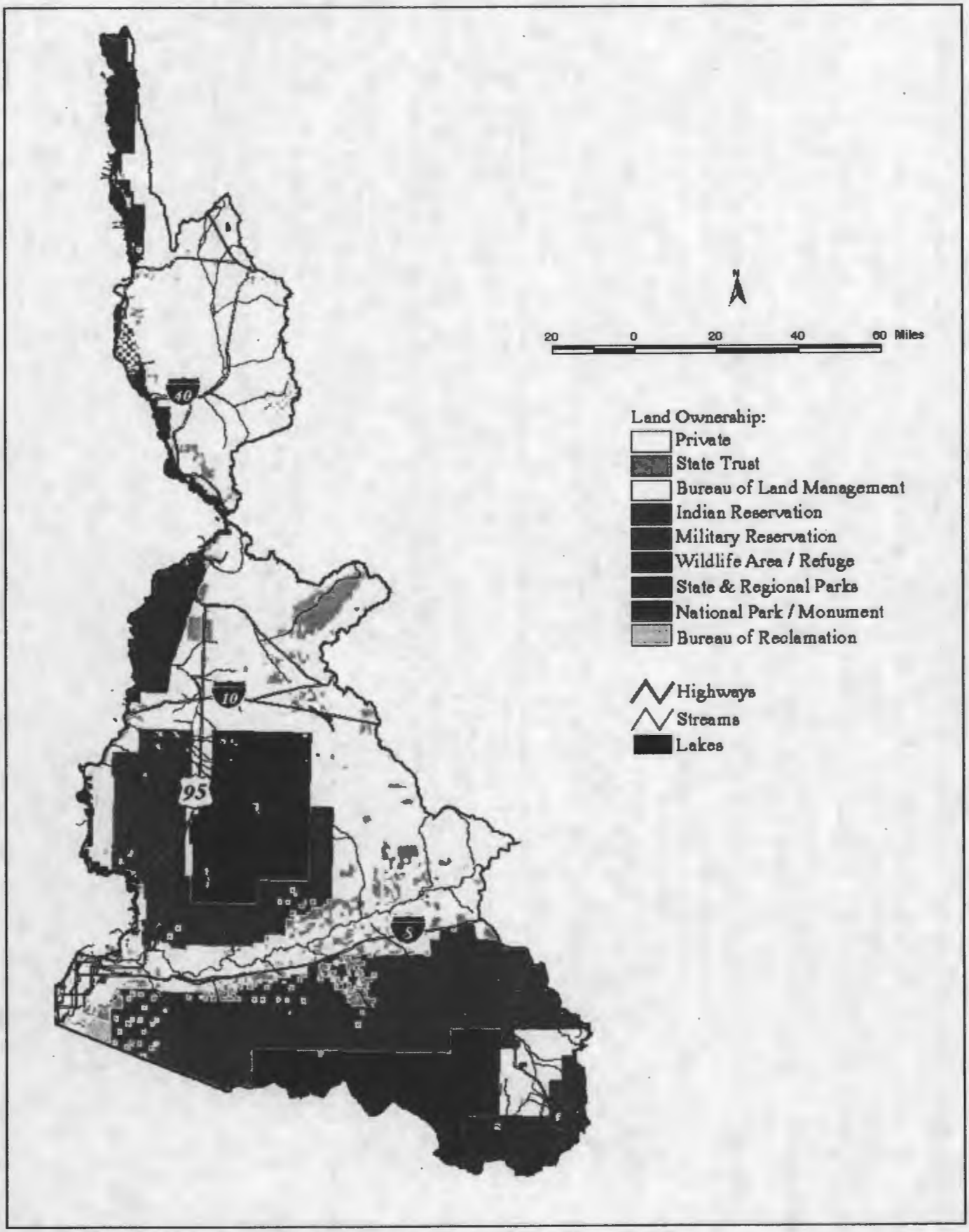

Figure 15. Land Ownership in the Colorado-Lower Gila Watershed

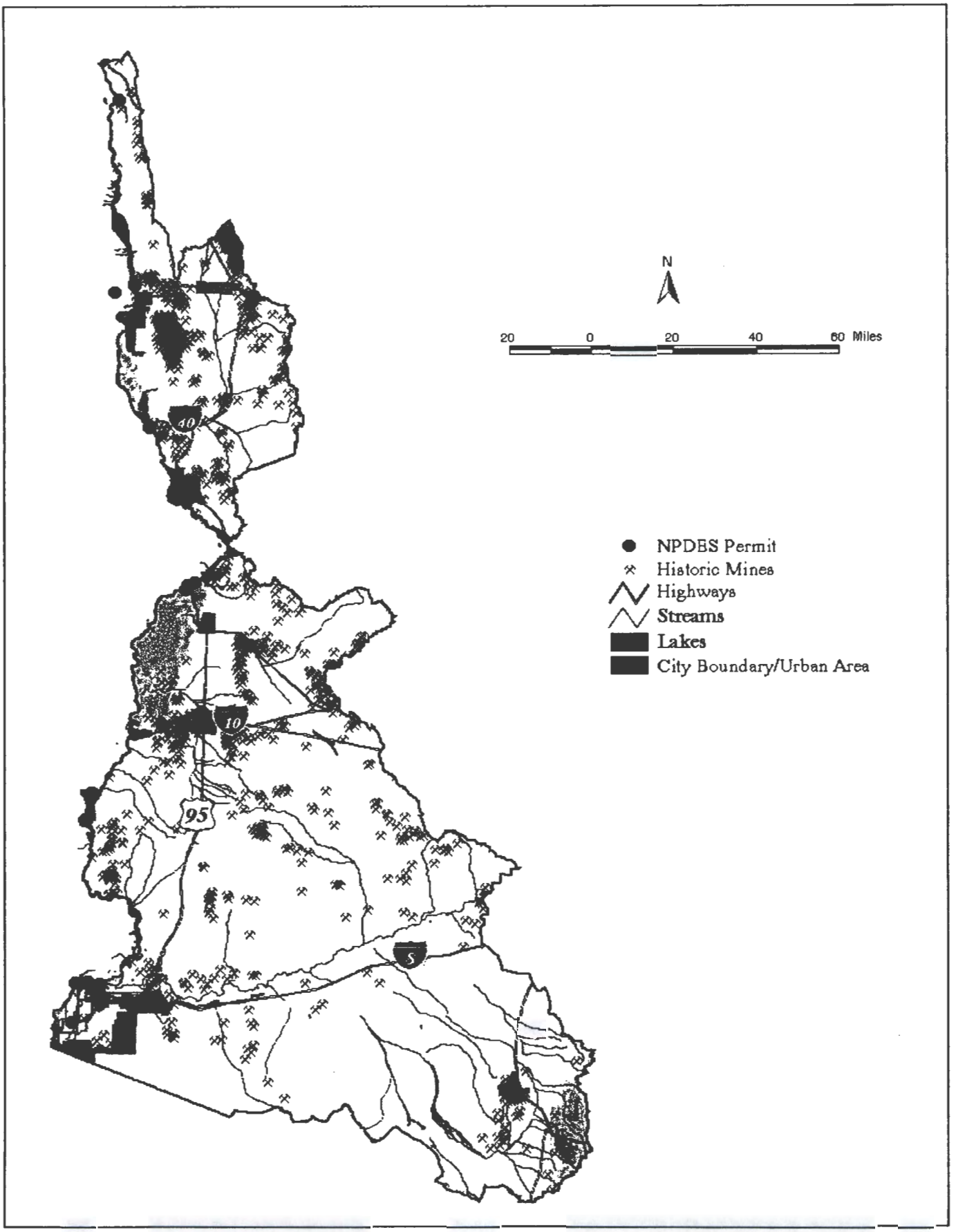

Figure 16. General Land Use and NPDES Permits in the Colorado-Lower Gila Watershed

Colorado-Lower Gila Watershed Assessment Discussion

Statistical Summary of Surface Water Assessments

Assessments – For the 2002 assessment, 132 stream miles and 29,156 lake acres were assessed. Fewer assessments were completed than previously because of two factors: 1) changes in assessment criteria requiring more data to base an assessment, and 2) a lack of current credible data. This watershed will be a focus for water quality monitoring in 2003.

Water quality assessment information for the Colorado-Lower Gila Watershed is summarized in the following tables and illustrated on **Figure 17**.

Table 9. Assessments in the Colorado-Lower Gila Watershed – 2002

	STREAMS		LAKES	
	miles	number of segments	acres	number of lakes
ATTAINING	132	5	16,120	1
INCONCLUSIVE	0	0	12,850	1
IMPAIRED	0	0	186	1
NOT ATTAINING	0	0		
TOTAL ASSESSED	132	5	29,156	3

PERENNIAL SURFACE WATERS ASSESSED		STREAMS		LAKES	
		miles	number of segments	acres	number of lakes
	Assessed	132	5	29,156	3

* Note that streams with significant perennial stretches within the reach assessed were included in the perennial milage although part of the reach may have ephemeral or intermittent flow.

Inconclusive assessments – As shown in the following monitoring table, all reaches in this watershed were assessed as "attaining," however, some of the designated uses were assessed as "inconclusive." All surface waters with a designated use assessed as "inconclusive" were added to the new Planning List. By the end of the focused watershed monitoring (scheduled in 2003), ADEQ expects to monitor most of these reaches so that all designated uses can be assessed during the following assessment cycle. Other lakes and streams which lack monitoring data will also be monitored depending on resources and priorities.

ADEQ will be coordinating with the USGS and the Bureau of Reclamation, which collect monitoring data on the Colorado River, reservoirs, and back waters, so that future monitoring efforts will better support Arizona's surface quality water assessments.

Major stressors – When a surface water is listed as impaired, the pollutants or suspected pollutants causing the impairment are identified. Only one lake is to be listed as impaired in this watershed: Painted Rocks Borrow Pit Lake. This lake is impaired due to low dissolved oxygen and high fecal coliform.

An investigation is needed to determine whether the low dissolved oxygen is due to pollutants or is due to natural drying conditions at the lake. ADEQ has adopted new surface water standards that replace the fecal coliform standard with an Escherichia coli standard. These new standards still need to be approved by EPA. If adopted they would bring this lake into compliance with bacterial standards as Escherichia coli standards are being met.

Watershed assessment map (Fig 48

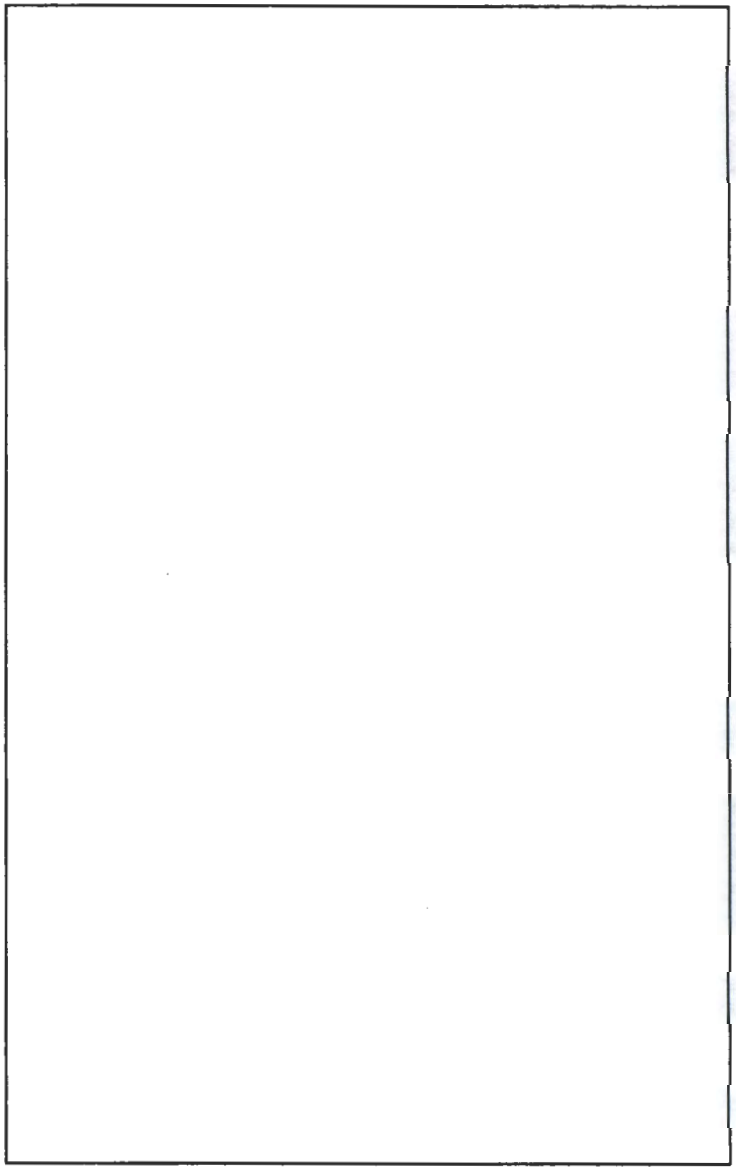

TABLE 10. COLORADO - LOWER GILA WATERSHED -- 2002 ASSESSMENT -- MONITORING DATA

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
STREAM MONITORING DATA								
Colorado River Hoover Dam-Lake Mohave AZ15030101-015 A&Wc, FC, FBC, DWS, AgI, AgL	USGS Station 09421500 At Hoover Dam CMCLR243.26	1996 - 11 suites 1997 - 6 suites 1998 - 6 suites 1999 - 6 suites	Dissolved oxygen mg/L	7.0 90% saturation (A&Wc)	6.1-10.4 56-101% saturation	3 of 29		Naturally occurring low dissolved oxygen because water release at dam is from lake bottom. Missing core parameters: total mercury, arsenic, beryllium, barium, fluoride, copper, manganese, and Escherichia coli.
	Reach Summary Row A&Ww Attaining FC Inconclusive FBC Inconclusive DWS Inconclusive AgI Inconclusive AgL Inconclusive	1996-2000 29 sampling events Missing core parameters	OK				Attaining	US Geological Survey collected 29 samples in1996-1999. Reach assessed as "attaining some uses"and was placed on the Planning List due to missing core parameters.
Colorado River Bill Williams R.-Osborne AZ15030104-020 A&Ww, FC, FBC, DWS, AgI, AgL	USGS Station 09427520 Below Parker Dam CMCLR127.02	1996 - 6 suites 1997 - 6 suites 1998 - 6 suites 1999 - 2 suites, 1 field 2000 - 4 suites	OK					
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining DWS Attaining AgI Attaining AgL Attaining	1996-2000 25 sampling events	OK				Attaining	US Geological Survey monitoring at 1 site for a total of 25 sample events. Reach assessed as "attaining all uses."
Colorado River Indian Wash-Imperial Dam AZ15030104-001 A&Ww, FC, FBC, DWS, AgI, AgL	USGS Station 09429490 Above Imperial Dam CMCLR029.79	1996 - 1 suite 1997 - 6 suites 1998 - 6 suites 1999 - 6 suites 2000 - 3 suites	OK					Missing core parameters: total mercury, arsenic, beryllium, barium, fluoride, copper, manganese, and Escherichia coli.
	Reach Summary Row A&Ww Attaining FC Inconclusive FBC Inconclusive DWS Inconclusive AgI Inconclusive AgL Inconclusive	1996-2000 22 sampling events Missing core parameters	OK				Attaining	US Geological Survey monitoring at 1 site for a total of 22 sample events. Reach assessed as "attaining some uses" and was placed on the Planning List due to missing core parameters.
Colorado River Main Canal-Mexico border AZ15030107-001 A&Ww, FC, FBC, AgI, AgL	USGS Station 09522000 International boundary (Mexico) CMCLR015.85	1996 - 4 suites 1997 - 4 suites 1998 - 6 suites 1999 - 6suites 2000 - 6suites	OK					

TABLE 10. COLORADO - LOWER GILA WATERSHED -- 2002 ASSESSMENT -- MONITORING DATA

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining DWS Attaining Agl Attaining AgL Attaining	1996-2000 26 sampling events	OK				Attaining	US Geological Survey monitoring at 1 site for a total of 26 sample events. Reach assessed as "attaining all uses."
Gila River Coyote-Fortuna AZ15070201-003 A&Ww, FC, FBC, Agl, AgL	ADEQ Fixed Station Network Near Dome, USGS #09520500 LGGLR005.75 100455	1996 - 5 suites 1997 - 3 suites 1998 - 4 suites 1999 - 4 suites 2000 - 4 suites	Boron (total) µg/L	1000 (Agl)	100-1500	4 of 20		
			Dissolved oxygen mg/L	6.0 90% saturation (AW&w)	3.22-11.8 40% - 125%	1 of 18		
			Thallium µg/L	12 (FBC)	2.0 - 20	1 of 19		
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining AgL Attaining Agl Inconclusive	1996-2000 20 sampling events	Boron (total) µg/L	1000 (Agl)	100-1500	4 of 20	Inconclusive	ADEQ collected 20 samples in 1996-2000. Agriculture Reach assessed as "attaining some uses" due to boron exceedances.
			Dissolved oxygen mg/L	6.0 90% saturation (AW&w)	3.22-11.8 40% - 125%	1 of 18	Attaining	
			Thallium µg/L	12 (FBC)	2.0 - 20	1 of 19	Attaining	
LAKES MONITORING DATA								
Lake Havasu AZL15030101-0590 A&Ww, FC, FBC, DWS, Agl, AgL	Mohave County Swimming Area Monitoring CMHAV	2000 - 867 bacteria	OK					
	ADEQ Lakes Program Dam Site, Parker Dam CMHAV-A 100098	1996 - 2 suites 1997 - 2 suites 1998 - 1 suite 2000 - 2 suites	OK					Missing core parameters: bacteria
	ADEQLakes Program CMHAV-B 100102	1996 - 2 suites 1997 - 2 suites 1998 - 1 suite 2000 - 2 suites	OK					
	ADEQ Lakes Program CMHAV-C 100099	1996 - 2 suites 1997 - 2 suites 1998 - 1 suite	OK					
	ADEQ Lakes Program Colorado River CMHAV-CRA 100101	1996 - 2 field 1997 - 1 field 1998 - 1 field 2000 - 2 suites	OK					
	ADEQ Lakes Program Crazy Horse Cove CMHAV-CHC 100139	2000 - 1 field, 1 bact	OK					

TABLE 10. COLORADO - LOWER GILA WATERSHED -- 2002 ASSESSMENT -- MONITORING DATA

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Lakes Program CMHAV-E 100100	1996 - 2 suites 1997 - 1 suite, 1field 1998 - 1 field	OK					Missing core parameters: bacteria
	ADEQ Lakes Program Grass Island CMHAV-GI 100144	2000 - 1 bact	OK					
	ADEQ Lakes Program Hole in Rock CMHAV-HIR 100145	1996 - 2 field 1997 - 2 field 1998 - 1 field	OK					
	ADEQ Lakes Program Off Windsor Beach CMHAV-OFFWB 100155	2000 - 1 field	OK					
	ADEQ Lakes Program Pilot Rock CMHAV-PR 100157	1999 - 2 field 2000 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay @ East State Beach Shore CMHAV-ESB 100141	1996 - 2 field 1997 - 2 field 1998 - 1 field 1999 - 1 bact 2000 - 1 field, 1 bact	OK					
	ADEQ Lakes Program Thompson Bay @ East State B. CMHAV-ESBSH 100117	1996 - 2 field 1997 - 2 field	OK					
	ADEQ Lakes Program Thompson Bay @ Golf Course West Shore CMHAV-GCPWS 100143	1996 - 2 field	Turbidity NTU	25 (A&Ww)	32.7-62.6	1 of 1 event		Two high result of two was reportedly from wave action (0.4 meters below the surface).
	ADEQ Lakes Program Thompson Bay @ Golf Course CMHAV-GCP 100142	1996 - 2 field 1997 - 2 field	Turbidity NTU	25 (A&Ww)	7.30-30.4	1 of 1 event		One high result of 30.was reportedly at the bottom (9.8 meters below the surface).
	ADEQ Lakes Program Thompson Bay @ Marina CMHAV-MARA 100167	2000 - 1 suite	OK					
	ADEQ Lakes Program Thompson Bay @ Mid Bay CMHAV-MB 100149	1999 - 1 field 2000 - 2 field	OK					
	ADEQ Lakes Program Thompson Bay @ Mid Channel CMHAV-MC 100150	1999 - 1 bact 2000 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay @ Nautical Bch CMHAV-NB-A 100153	1999 - 1 bact 2000 - 1 field	OK					

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Lakes Program Thompson bay @ Nautical Beach (off volleyball courts) CMHAV-NBEAC 100152	1999 - 1 bact	OK					
	ADEQ Lakes Program Thompson Bay @ Rotary Beach CMHAV-ROT1 100121	1996 - 1 field 1999 - 1 bact	OK					
	ADEQ Lakes Program Thompson Bay @ Rotary Beach CMHAV-ROT2 100159	2000 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay @ Rotary Beach CMHAV-ROT3 100122	1996 - 1 field 1999 - 1 bact	OK					
	ADEQ Lakes Progrem Thompson Bay @ Rotary Beach CMHAV-ROT3 100123	1996 - 1 field 1999 - 1 bact 2000 - 1 bact	OK					
	ADEQ Lakes Program Thompson Bay @ Nautical Cove CMHAV-NAUTC 100151	1996 - 1 field 1997 - 1 field 1999 - 1 bact 2000 - 1 field, 1 bact	OK					
	ADEQ Lakes Program South Channel CMHAV-SC 100164	1999 - 1 bact 2000 - 1 field, 1 bact	OK					
	ADEQ Lakes Program Thompson Bay - West State B. CMHAV-WSB 100166	1996 - 2 field 1997 - 2 field 1999 - 1 bact 2000 - 1 field, 1 bact	OK					
	ADEQ Lakes Program Thompson Bey - West State B. CMHAV-WSBSH 100171	1996 - 2 field 1997 - 2 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-137152 100129	1996 - 2 field 1997 - 2 field 1999 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-137 100125	1996 - 2 field 1997 - 2 field 1999 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-140 100126	1996 - 2 field 1997 - 2 field 1999 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-OW140 100169	1996 - 1 field 1997 - 1 field 1998 - 1 field	OK					

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Lakes Program Thompson Bay CMHAV-142 100127	1996 - 2 field 1997 - 2 field 1999 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-144 100144	1996 -1 field 2000 -1 suite	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-147 100174	1997 - 1 field 1998 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-149 100177	1996 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-152 100094	1996 - 2 field 1997 - 2 field 1999 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-152WS 100181	1996 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-149WS 100178	1996 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-OW149 100170	1996 - 1 field 1997 - 2 field 1999 - 1 field	OK					
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining DWS Attaining AgL Attaining	**1996-2000** **129 Chemistry samples** **6 sampling events** **867 bacterial samples**	**Turbidity NTU**	**25 (A&Ww)**	**0 -105**	**1 of 112 events**	**Attaining**	**ADEQ monitoring at 40 sites with a total of 129 samples. Additionally, Mohave County conducted bacteria monitoring at 6 sites with a total of 867 bacterial samples. This lake is assessed as "attaining all uses."**
Lake Mohave AZL15030101-0960 A&Wc, FC, FBC, DWS, Agl, AgL	ADEQ Lakes Program CMMOH - A 100030	1996 - 1 suite	OK					Missing core parameters: bacteria
	ADEQ Lakes Program CMMOH - CRMR 100031	1996 - 1 field	OK					
	ADEQ Lakes Program CMMOH - CRRR 100032	1996 - 1 field	OK					
	ADEQ Lakes Program CMMOH - E 100033	1996 - 1 suite	OK					

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	AGFD Routine Monitoring Near El Dorado	1996 - 2 suites	OK					Missing core parameters: turbidity, bacteria, all metals, fluoride, boron, barium,
	AGFD Routine Monitoring Near Monkey Rock	1996 - 2 suites	OK					
	AGFD Routine Monitoring Near Hoover Dam	1996 - 2 suites	OK					
	AGFD Routine Monitoring Near Ringbolt Rapids	1996 - 2 suites	OK					
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive AgL Inconclusive	1996 9 samples 3 sampling events Missing core parameters	OK				Inconclusive	ADEQ monitored 4 sites during 1 sample event and Arizona Game and Fish Dept. monitored 4 sites during 2 sample events. This lake is assessed as "Inconclusive" due to insufficient parametric coverage and was placed on the Planning List.
Painted Rock Borrow Pit Lake AZL15070201-1010 A&Ww, FC, FBC, AgI, AgL	USFWS/COE Routine Monitoring LGPRL	1996 - 6 suites, 2 Sulfide 1997 - 5 suites 1998 - 5 suites, 2 DO 1999 - 8 suites 2000 - 2 field, 1 bact, 2 nutrients	Dissolved oxygen mg/L	6.0 90% saturation (A&Ww)	1.77-19.82	7 of 30		
			Sulfide mg/L	0.1 (A&Ww)	0.0-40	1 of 24		
			Fecal Coliform cfu/100 ml	4000 (A&Ww, FBC, AgL)	10-200,000	5 of 21		
			pH (high) SU	6.5-9.0 (FBC, AgL)	6.99-9.46	1 of 30		
	Reach Summary Row A&Ww Impaired FC Inconclusive FBC Attaining AgI Impaired AgL Impaired	1996 -2000 sampling events 30	Dissolved oxygen mg/L	6.0 90%saturation (A&Ww)	1.77-19.82	7 of 30	Impaired	US Fish and Wildlife Services conducted monitoring at 1 sites with a total of 30 sample events. Lake assessed as "impaired" due to fecal coliform and low dissolved oxygen. Fish tissue contamination by historically used pesticides has lead to a fish consumption advisory. FC is assessed as inconclusive.
			Fecal Coliform cfu/100 ml	4000 (A&Ww, AgI, AgL)	10-200,000	5 of 21	Impaired	
			pH (high) SU	6.5-9.0 (FBC, AgL)	6.99-9.46	1 of 30	Attaining	
			Sulfide mg/L	0.1 (A&Ww)	0.0-40	1 of 24	Attaining	

Information for Interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from AZ (streams) or AZL (lakes) + Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses", "Agency", and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector). Note that watersheds may include multiple surface water basins.
- "ADEQ Database ID" -- This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" -- The year and number of water samples is shown. The federal "water year is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
  - "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among samples as many different programs and agencies provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
  - "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
  - [Parameter] A specific parameter or parametric group (e.g., zinc, metals, bacteria) is named if monitoring was limited to only these parameters.

- "Standards Exceeded at this Site per Sampling Event."
  - Although many parameters may be analyzed, only those exceeding a standard are shown.
  - "OK" indicates that no standards were exceeded.
  - A single parameter may have multiple standards, varying based on designated uses assigned. The standard for the total and dissolved fraction of some parameters may also vary. Some standards vary based on water hardness, water temperature, pH, or time of day of the sample.
  - "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
  - A mean or geometric mean will be shown along with the range of results if applicable to the standard.
- "Designated Use Support" shows the impact of the exceedance(s) on the designated use(s): "Attaining," "Not attaining," "Impaired," or " Inconclusive." The rather complex criteria used for making these assessments is detailed in Chapter III of Volume I..
- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- The "Summary Row" combines all of the monitoring data and other assessment information available. Parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field.

Ground Water Assessments in the Colorado-Lower Gila Watershed

Major Ground Water Stressors -- Monitoring data collected from wells in this watershed between October 1995-October 2000 are summarized in **Table 11** and illustrated in **Figure 18, 19, and 20.** As **Table 11** indicates, wells are sampled for different constituents.

Many of the wells monitored **(Figure 18)** were part of two ground water basin studies conducted in this watershed Section. These studies provide a lot of information about water quality in this watershed. See the discussion of these two studies in the Watershed Studies and Alternative Solutions (following the maps).

All of the radiochemcial exceedances appear to be related to the Sacramento Ground Water Basin study. Fluoride and nitrate contamination seems to be widespread across the watershed, while metal and volatile organic chemicals contamination is isolated in pockets. It is interesting to note that although significant irrigated crop production has occurred in this watershed, no pesticides exceeded any standards and only six (6) wells among the 120 wells monitored even detected pesticides. Note that wells are not normally sampled for radiochemicals, volatile organic chemicals, or pesticides, except as part of a special study or investigation due to the high costs of running these analyses.

TDS concentrations – Water quality can be characterized based on concentration of Total Dissolved Solids. High levels of salinity limits the practical uses of ground water in some areas of this watershed as TDS over 500 mg/L has an off-flavor, and TDS over 1000 mg/L will limit its use for some crops. Of the 151 wells monitored for TDS, 85% were over 500 mg/L and 61% were over the 1000 mg/L. As illustrated in **Figure 19**, very high TDS concentrations occur in wells in the Yuma area. (See TDS discussion in the Yuma Groundwater Basin study.)

A flow-weighted average annual salinity surface water standard is established on the Colorado River below Hoover Dam, below Parker Dam, and at Imperial Dam in this watershed. These standards were established by Arizona as part of the federally administered Colorado River Basin Salinity Control Program, and these standards are being met. (More information about the Colorado River Basin Salinity Control Program is provided in the statewide research discussion of this report.)

The elevated levels of TDS do not present a human-health concern for drinking waters. The TDS concentration is only used to generally characterize water quality.

Nitrate concentrations – Water quality can also be characterized by looking at the concentration of nitrates in ground water. Naturally occurring nitrate concentrations in ground water are generally below 3 mg/L. Concentrations above 5 mg/L indicate potential anthropogenic sources of nitrate. Of the 196 wells monitored for nitrate, 30% exceeded this 5 mg/L concentration. As illustrated in **Figure 20**, these wells are scattered across the watershed. These areas may be related to historic irrigated agriculture or septic systems.

When nitrate concentrations exceed 10 mg/L, Arizona's Aquifer Water Quality Standard has been exceeded. This standard was set to protect human health , as water with nitrate greater than 10 mg/L may present a health problem for babies and should not be consumed by nursing mothers. Thirty-five of the 196 wells monitored (18%) exceeded 10 mg/L. As many of these wells may be irrigation wells (not used for drinking water), nitrates over 10mg/L may not represent a human-health concern. However, efforts should be made to minimize further contamination of ground water by nitrate.

Table 11. Colorado-Lower Gila Watershed Ground Water Monitoring 1996 - 2000

MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	34		8	23%
	Fluoride	43		2	5%
	Metals/Metaloids	43		0	0%
	Nitrate	44		8	19%
	VOCs + SVOCs*	39	2	0	0%
	Pesticides	39	2	0	0%
TARGETED MONITORING WELLS	Radiochemicals	6		4	67%
	Fluoride	142		27	10%
	Metals/metaloids	153		12	8%
	Nitrate	152		27	18%
	VOCs + SVOCs*	81	11	8	10%
	Pesticides	81	4	0	0%

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
151	22	37	80	12

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
196	137	24	35

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.

*The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.

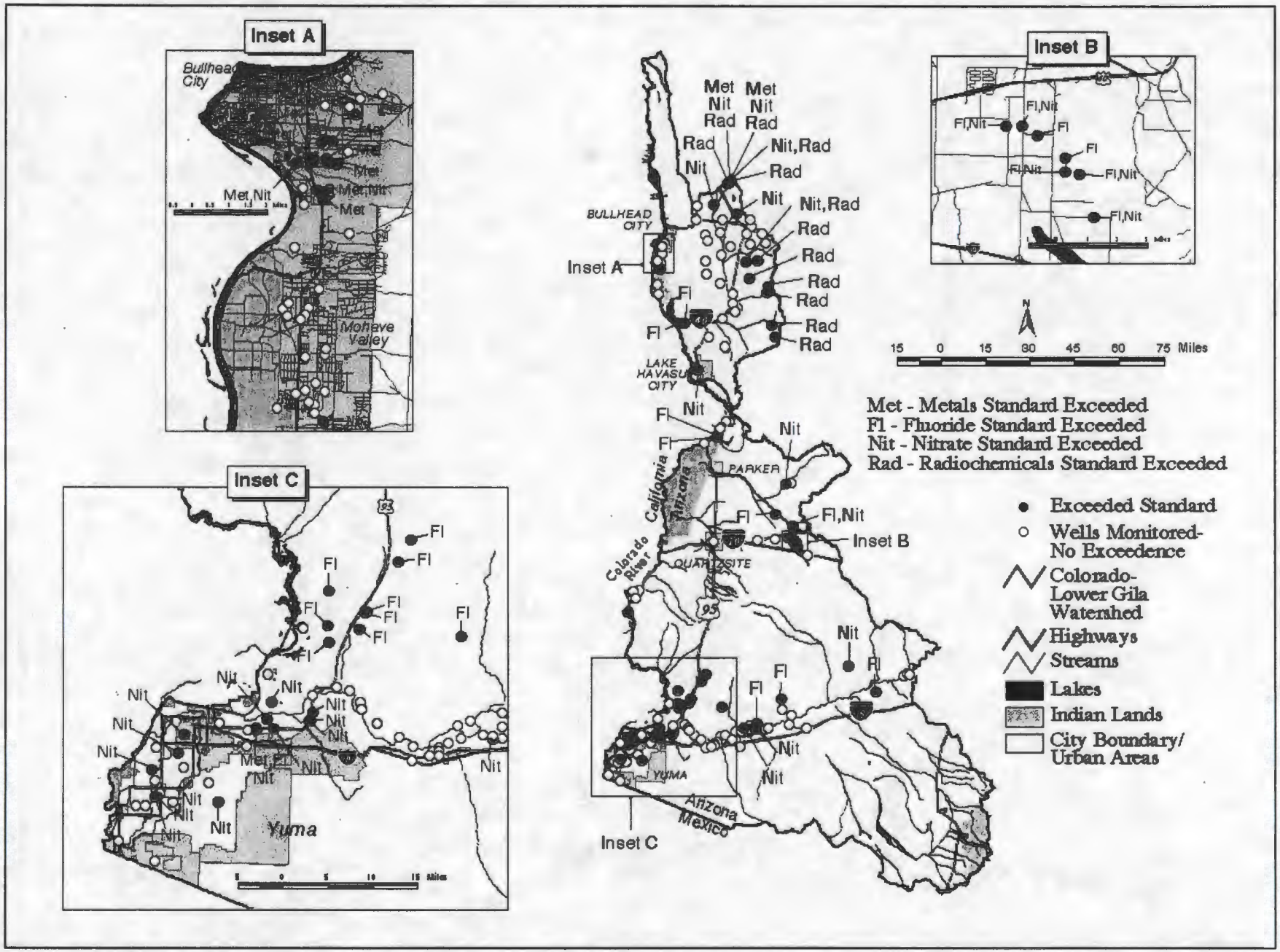

Figure 18. Ground Water Monitoring in the Colorado-Lower Gila Watershed

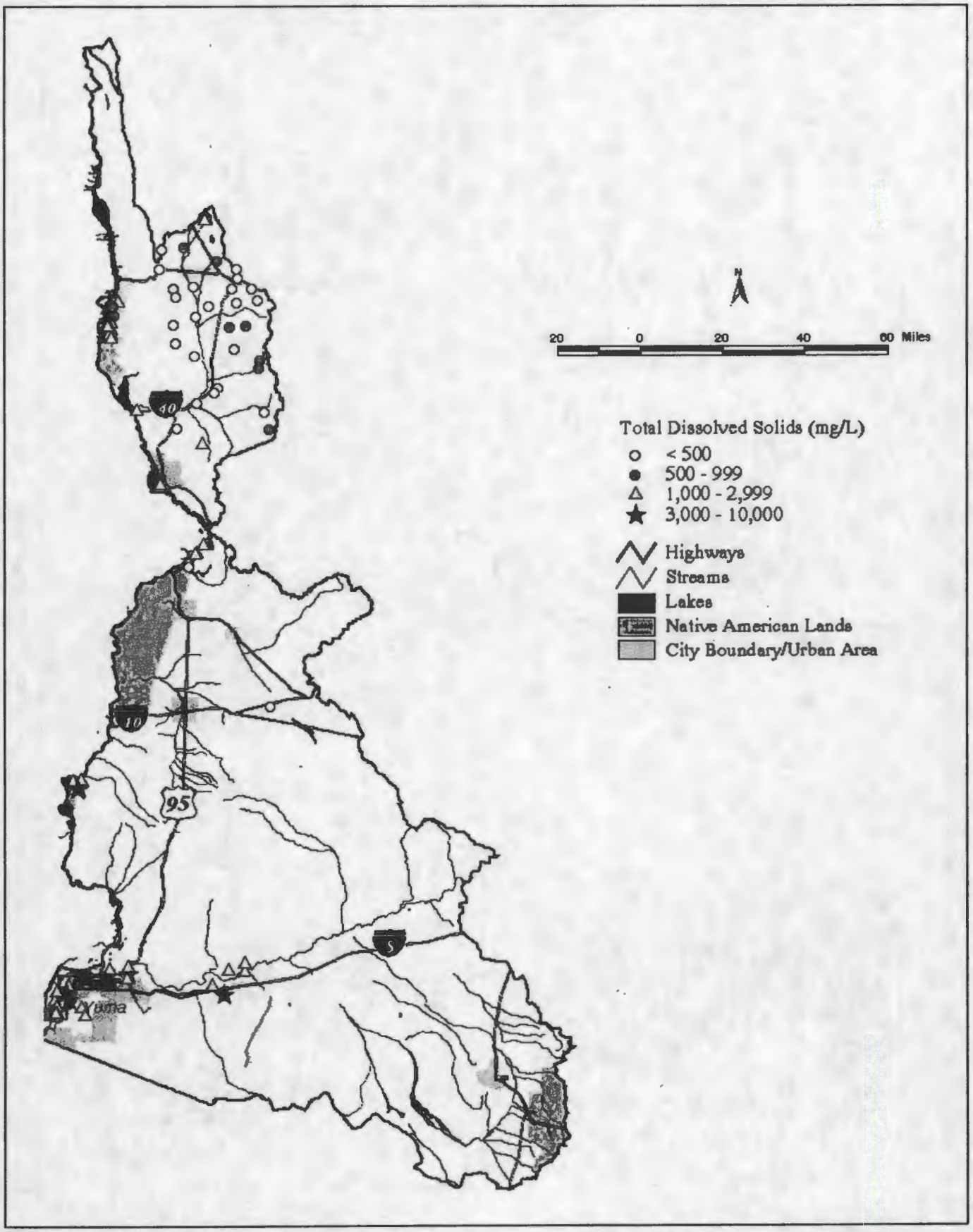

Figure 19. Classification of Ground Water Quality by TDS Concentrations in the Colorado-Lower Gila Watershed

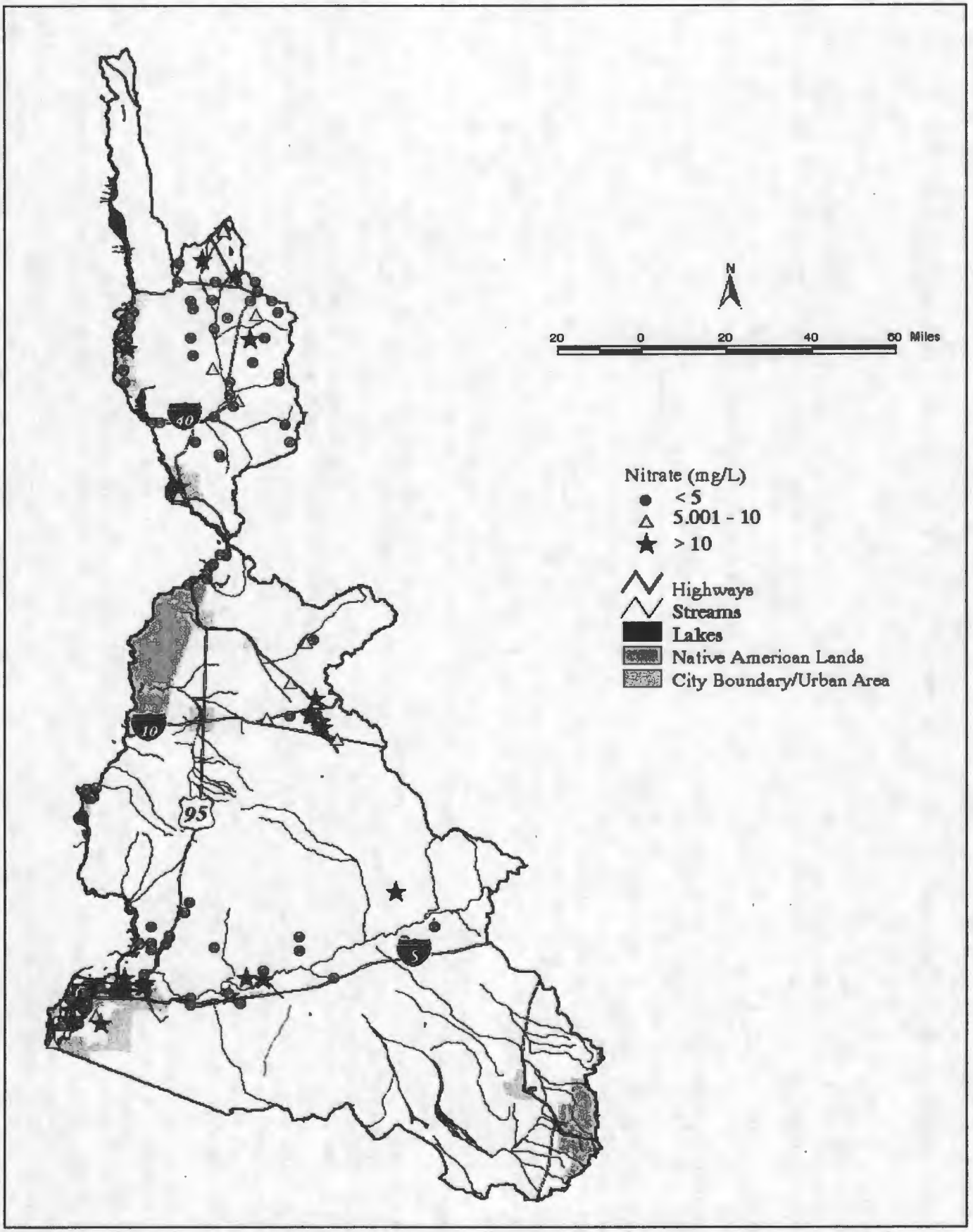

Figure 20. Classification of Ground Water Quality by Nitrate Concentration – Colorado-Lower Gila Watershed

Watershed Studies and Alternative Solutions in the Colorado-Lower Gila Watershed

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the Colorado-Lower Gila Watershed. Watershed partnerships active in this watershed are also mentioned.

Surface Water Studies and Mitigation Projects

Yuma East Wetlands Restoration – The Yuma East Wetlands extends along the Colorado River from the Gila confluence to the Ocean-to-Ocean Bridge between the north and south river levees. The restoration area includes 1100 acres of riparian habitat, 148 acres of open water, 98 acres of marshland, and 20 acres of agriculture. The Yuma East Wetlands Restoration Plan (developed by Philips Consulting for the Riverfront Development Office, City of Yuma) aims to restore native riparian, wetland, and aquatic habitats along the lower Colorado River and create an interpretive, cultural center, and nature park for education and low-impact recreation opportunities.

Over the past century, riparian areas surrounding the Yuma East Wetlands have been drastically altered. Fires and human consumption have decimated native stands of cottonwood, willow, and mesquite (honey and screwbean), while the non-native salt cedar populations have overrun the river area. The historic damming and confinement of the river channel have decreased seasonal flooding, ending the natural process of soil desalinization. Where soil salt levels have increased, trees such as the cottonwood and willow, which cannot tolerate high soil salt levels, have been unable to thrive and regenerate. Thus, salt cedar (perfectly suited to high salt levels) thrives in the absence of serious competition from native plant species. Unfortunately, salt cedar, for various reasons, supports less wildlife than native vegetation. Wildlife populations, especially migratory bird populations, have declined with the loss of suitable habitat.

While simple replacement of salt cedar by native vegetation is problematic, the restoration of native vegetation through removal of exotic species on the first (lower) terrace, the use of excavated materials to assure hospitable soil for a second terrace, along with extensive soil sampling at planting sites, should encourage the return of native vegetation and wildlife. In conjunction with these proposed actions, the natural sediment influx and flooding from the Gila River will allow for the continued regeneration of native plants (such as cottonwood and willow).

Yuma East Wetlands revegetation activities will commence in areas deemed suitable for revegetation. Site selection criteria will be established to select optimum revegetation areas. The goal is to maximize successful establishment of native species, minimize amount of future maintenance required, and design stands to minimize threat from wildfire.

Revegetation activities will be monitored for success, to guide future maintenance activities and optimize future revegetation projects on the lower Colorado River. Monitoring will include bird censuses to establish base line data, protect sensitive species, and monitor success of revegetation efforts.

An interpretive center and nature park is proposed to act as the main staging area for the entire project. This area could accommodate the Yuma East Wetlands offices, a children's center, traditional gardens, ceremonial grounds, a swimming beach and fishing area, picnic areas, shade ramadas, and a trail system that connects the interpretive center with the surrounding historical sites. This area may also serve as an outdoor, cultural and environmental classroom for community schools and organizations. It will be ideal for hosting traditional community gatherings, field trips, special interest groups, summer camps and act as a staging ground for Yuma East Wetland activities.

Other low-impact recreational opportunities in the Yuma East Wetlands will include bird observation platforms with interpretive signs, a canoe trail along the main river channel with primitive day use facilities and wildlife/bird watching trails in the restored areas.

The combination of restoration, education, and intercommunity involvement will add to the success of this important restoration project. The projects goals include the following items:

- Enhance the natural river channel dynamics by manipulating sediment loads, thereby decreasing river maintenance requirements.
- Excavate historic channels to improve water quality and flow in the existing wetlands.
- Stabilize excavated channel material, riverbanks, and sensitive lowland

sites using revegetation methods.

- Improve hydrology and enhance wetlands and backwaters utilizing new and existing water control structures, such as the filtered effluent from the city of Yuma water plant.
- Create and enhance fish and wildlife habitats in the wetlands.
- Establish native fish habitat, isolated from the main river channel.
- Establish an interpretive, cultural center, and nature park for education and low-impact recreation opportunities.
- Improve safety and aesthetic value by cleaning up illegal dumping sites in the project area.
- Reduce the amount of undesirable and illegal human activities by relocating homeless Yuma East Wetland residents in a respectful and helpful manner.
- Involve the Quechan and Yuma communities throughout all aspects of the restoration operations. Respect Quechan Tribal cultural resources and values throughout the planning and restoration process. Provide cultural, educational and economic opportunities for the Yuma and Quechan communities.

In addition to the Quechan Indian Nation, this project involves a number of public and private landowners and stakeholders including, the City of Yuma, the Bureau of Land Management, the Bureau of Reclamation, Arizona State Land Department, United States Fish and Wildlife, Arizona Game and Fish. It is important that the wildlife and natural resources of this area be preserved for present and future generations.

Regrowth of Fecal Coliform in Swim Areas of Lake Havasu, Arizona -- In 1994, extremely elevated concentrations of fecal coliform bacteria (greater than 80,000 CFU/100 ml) were detected in several swim areas of Lake Havasu, and another occurrence at lower concentrations the following year. Because these concentrations far exceeded the Arizona surface water quality standard for swimming areas (800 CFU/100 ml at that time), many swim areas were closed in 1994 and 1995, disrupting the economy of the commercial resorts and recreation areas.

ADEQ led extensive investigations into the nature and cause of these high bacteria concentrations (ADEQ, 1997). The investigations focused on the following aspects of the phenomenon:

- Spatial and temporal distribution of bacteria in swimming area waters;
- Chemistry of lake water, ground water, and shoreline sediments;
- Speciation of bacteria within the fecal coliform group and related microbiological investigations of parasites, viruses, and pathogenic organisms;
- Thermal structure and hydraulic characteristics of the lake;
- Water and nutrient materials balance of the municipal wastewater treatment plant located on an island in Havasu Lake and the treatment plants related irrigation and fertilization practices; and
- Regrowth of fecal coliform bacteria in shoreline sediments and water.

This report indicates a link between the discharge of wastewater from the city's onsite wastewater treatment plant, elevated water temperatures, and elevated *Escherichia coli* in swimming areas. The link is not based on the transport of bacteria, but may be due to nutrient enrichment. Long-term recommendations included reducing and eliminating the discharge of effluent on the Island. Short-term recommendations encouraged the dredging, resanding, and rototilling all beaches and coves where fecal coliform exceeded the standards.

Water Quality Improvement Grant Projects – ADEQ has awarded the following Water Quality Improvement (319h) Grants:

- The Greater Kingman Wildcat Dump Cleanup Project – (See discussion in the Colorado-Grand Canyon Watershed.)

Water Protection Fund Projects – The following projects received Water Protection Funds from ADWR.

- Lower Colorado River - Imperial Division Restoration – The Bureau of Reclamation is restoring stream flow to small backwater channels and about 50 acres of dried-out wetlands along the lower Colorado River. Areas will be revegetated with native riparian plant species. The grantee hopes to create higher quality riparian and aquatic habitat along this reach of the river.

- Ahakhav Tribal Preserve - Deer Island Revegetation – The `Ahakhav Tribal Preserve on the Colorado River Indian Reservation is approximately 1042 acres in size. The construction of dams and channelization of the Colorado River, as well as the introduction of the exotic and invasive salt cedar, has left the Preserve nearly devoid of cottonwoods and willows. Because salt cedar does not provide

adequate cover, food and thermal protection, this habitat type supports a significantly lower diversity of insects, birds and other wildlife. The Colorado River Indian Tribes removed low-quality exotic plants near the Deer Island backwater, and revegetated the site with native plants including cottonwood, willow, mesquite, wolfberry and four-wing saltbush. The project was completed in 2000.

- Watershed Restoration at the Yuma Conservation Gardens – Yuma Conservation Garden received funding to renovate a five acre model watershed that is used as an outdoor classroom at the Yuma Conservation Garden. The Garden is a 28-acre natural area established in the 1950's for education and recreational purposes. The project area was established in 1962, and is used to teach the public about watershed issues in the Yuma area. The project was completed in 2000.

Colorado River Sediment Chemical Analysis – In 1998, the Bureau of Reclamation collected sediment samples of the Colorado River from the Morales Dam to the confluence with the Gila River. The purposed of the study was to assist in evaluating dredging options, including disposal of dredged materials. Samples were collected every two miles and at three depths: surface, five to ten feet, and 10 to 15 feet.

Results indicated that soils in this segment are typically sands, with low levels of toxic contaminants. For this reason, the US Army Corps of Engineers classifies these soils as "category 1" materials which do not require further sampling and testing under section 404 of the Clean Water Act governing dredge and fill activities.

Colorado River Basin Salinity Control Program – (See previous discussion in Section III of this report.)

Ground Water Studies and Mitigation Projects

The Sacramento Valley Groundwater Basin Study – This ground water basin, located in northwestern Arizona, is an arid region with striking natural landscapes and a small, but rapidly growing population. Population increases are influenced by proximity to popular tourist destinations such as the Colorado River and Laughlin, Nevada, and by an abundance of relatively inexpensive and undeveloped private land. Ground water is the primary water source for municipal, domestic, industrial, mining, livestock, and irrigation in the basin. Population growth and associated economic development in the Sacramento Valley Groundwater Basin will likely increase demand on ground water and, over time, may influence water quality.

These ground water quality concerns prompted the Arizona Department of Environmental Quality to conduct a regional ground water quality study in 1999 to determine ground water suitability for drinking purposes, appraise current baseline conditions, and examine spatial ground water quality patterns.

Of the 48 sites sampled in this basin, only 54% met health-based aquifer water quality standards, and only 42% met aesthetics-based criteria. Water quality standard exceedances were identified in the following three principal areas:

- Near the town of Chloride, radiochemicals exceedances appear to be related to granite rock that occurs in much of the Hualapai and Cerbat Mountains. Radionuclide levels in ground water may have been exacerbated by the nearby historic and current mining activity. Nitrate exceedances also occur in this area. These exceedances may be related to the high-density of older septic systems used for domestic and commercial wastewater treatment. These systems are often situated in soils that are marginally suitable for septic use.
- In the central and southern Hualapai Mountains, radiochemistry exceedances also occur. In addition, aesthetic-based criteria for TDS, chloride, and sulfate were exceeded in or near the Cerbat and Hualapai Mountains. Previous studies have noted that ground water found in and near mountains is generally more mineralized than ground water in the center of the valley. Different geologic classifications, recharge sources, and precipitation reactions may contribute to this ground water quality pattern.
- Near the town of Topock, fluoride exceeds aquifer water quality standards, and TDS and chloride exceed aesthetic-based criteria. This may be due to dissolution reactions that increase constituent concentrations as ground water migrates down gradient within the basin.

The results of this study can be used in several ways, particularly to assist in the site selection for new wells for public or private drinking water supplies.

The Yuma Groundwater Basin Study - The Yuma Groundwater Basin, located in southwestern Arizona, is an area of startling geographic contrasts. Precipitation in this arid basin averages less than three inches annually, yet because of Colorado River irrigation, it is one of the world's most productive agricultural zones. Similarly, much of this is uninhabited desert, yet the basin has a large and growing population that increases seasonally with the arrival of a large winter visitor population. A variety of water related issues in the basin prompted the ADEQ to conduct a regional ground water quality study of this basin in 1995.

Ground water in the basin is fairly chemically uniform and similar to Colorado River water. This finding supports previous assertions that the ground water consists largely of recharged Colorado River water. Parameter concentration levels, particularly Total Dissolved Solids and major ions, are generally highest in Gila Valley, decline in Yuma Valley, and are lowest in Yuma Mesa.

The source of irrigation water appears to be a major factor in determining ground water quality. Colorado River water, diverted at Laguna Dam, has irrigated land in Yuma Valley and North Gila Valley since 1909. The Imperial Dam, constructed in 1938, largely replaced the functions of Laguna Dam. This dam extended Colorado River water for irrigation to the previously undeveloped Yuma Mesa in the 1940s and to portions of South Gila Valley in 1965, which had been irrigated with ground water since 1910.

Ground water quality often deteriorates in arid irrigated areas due to salt buildup as a result of evapotranspiration. The portion of irrigation water that is actually consumed by plants or lost to evaporation is virtually free of salts. Thus, the vast majority of salts that were in the original irrigation water remain and percolate down eventually to recharge the underlying aquifer. If ground water is pumped for irrigation use on nearby lands and the underlying aquifer receives recharge from the irrigation water applications, this continual recycling of ground water will dramatically increase the salinity of the aquifer over time. This process is exacerbated in areas of shallow ground water where the recycling process occurs quickly, as appears to be happening in South Gila Valley.

In contrast, recharging aquifers with Colorado River water that is lower in salinity (TDS) levels than the ground water would tend to have less of a cumulative salt load. Water percolating beneath Yuma Mesa moves toward the valleys and is extracted by drainage wells, further minimizing the salt impact there. These processes assist in explaining the high baseline salinity levels found throughout the Yuma Groundwater Basin, the particularly high salinity levels found in the Gila Valley where historically ground water has been used for irrigation, and the salinity differences among sub-areas.

Other factors such as irrigation history, ground water depth and movement, and soil type may also influence the Yuma Mesa's generally lower parameter levels. Irrigation on the mesa is a more recent phenomenon, and ground water depth is much greater. The high irrigation applications necessary to grow crops on the mesa's sandy soils (up to 22 acre-feet per year with citrus) quickly percolate. The resulting recharge and its associated salt load is largely flushed away from the ground water mound that has formed below the mesa toward both valleys. Interpretation of this study's results suggests that regional ground water quality conditions in the Yuma Groundwater Basin generally support drinking water uses, except for nitrate in the eastern South Gila Valley. However, Yuma area residents may prefer to use treated water or other sources for domestic purposes because of high salinity levels. Currently applied pesticides do not appear to be migrating to the ground water, perhaps because of their short half-lives. The banned pesticides, DBCP and EDB, which were detected in the early 1980s, appear to have been transported from the area via rapid ground water movement in the basin.

Cibola Ground Water Quality Study -- In 1997, ADEQ conducted a ground water quality study in Cibola, a small community located in southwestern La Paz County, Arizona. The area has experienced rapid development of winter and summer homes, and La Paz County expressed concerns that the related rapid increase of on-site wastewater disposal systems (septic systems) could pose a threat to ground water quality. La Paz County requested that ADEQ assist in collecting ground water quality data to identify potential sources of ground water contamination and assist in planning for future development.

ADEQ sampled five wells in the study area to evaluate the potential impacts from irrigated agriculture and on-site wastewater disposal systems on shallow ground water in this river aquifer system. Wells were sampled for dissolved metals, major cations and anions, nitrate and ammonia. None of these samples exceeded Arizona's Aquifer Water Quality Standards. However, aesthetic-based secondary drinking water criteria were exceeded in all five ground water samples as follows:

- Three wells exceeded 250 mg/L for chloride,
- Four wells exceeded 0.3 mg/L for iron,

- Five wells exceeded 0.05 mg/L for manganese
- Five wells exceeded 250 mg/L for sulfate, and
- Five wells exceeded 500 mg/L for total dissolved solids (TDS)

These high concentrations of chloride, sodium, sulfate, manganese and total dissolved solids contribute to aesthetically poor ground water quality (based upon taste, odor or color) in the study area. Although ground water in the study area is of poor aesthetic quality, use of ground water for drinking or cooking does not pose any significant health risk to the residents of the study area.

One sample had a nitrate (as nitrogen) level of 3.57 mg/L, well below the standard of 10.0 mg/L. It may indicate an anthropogenic source of nitrate since natural levels of nitrate are typically below 2 mg/L. Additional sampling would be necessary to determine the source of elevated nitrate levels but they can be added to the ground water by septic systems.

The ground water quality data collected will be useful to La Paz County as baseline data with which to measure the impacts of future development in the study area. The study recommended further monitoring to determine the source of elevated nitrate, and look at seasonal changes due to seasonal variations in population densities. The next study should expand the parameters to analyze for bacteria and where pesticides have been applied, sample for pesticides.

Federal and State Superfund Cleanup Sites -- Several state and federal Superfund and Department of Defense cleanup sites are located in the this watershed.

- 20th Street & Factor – The 20th Street and Factor Avenue site in Yuma, Arizona was added to the WQARF Registry in 2000 because of ground water contamination by tetrachloroethene (PCE). The remedial investigation was initiated in November 1999 and completed in June 2001. The draft remedial investigation report and land and water use study will be completed by September 2001.

- Yuma Marine Corps Air Station -- The Marine Corps Air Station Yuma occupies approximately 3,000 acres within the city and county of Yuma, Arizona. In February of 1990, this site was designated a National Priority List Superfund site by the Environmental Protection Agency. The investigation has been concerned with soil and ground water contamination. The contaminants of concern in soil are asbestos in the form of non-friable asbestos containing material and petroleum hydrocarbons from a jet fuel leak. The asbestos containing material is scattered on top of and buried in the surface soil.

In ground water, the contaminants of concern are trichloroethene (TCE), dichloroethene (DCE), tetrachloroethene (PCE) and petroleum hydrocarbons. The main ground water plume is approximately one mile long and 500 feet wide, and has reached the northwestern base boundary. The maximum concentration of total solvents is currently approximately 270 µg/L.

History: The facility originated during World War II as a training base and is currently being used by the Marine Corps for the training of tactical aircrews. Environmental impacts due to soil contamination and subsequent infiltration to ground water may have resulted from activities at several areas of the base. The shop area (for aircraft and vehicle maintenance since the 1940s) has been the site of disposal and spills. Disposal of waste motor oil, cleaning solvents, battery acid, and anti-freeze occurred outside the base hobby shop from 1960 to the early 1980s. Routine maintenance of vehicles resulted in spills at another site. Materials that could not be recycled, such as waste fuel, were burned at three areas. The Radar Hill burn disposal area had the resultant ash pushed to the south and covered with soil. There are other base landfills that were used for waste disposal, as well as for the application of waste for dust control. Lagoons were built on the base for evaporative sewage treatment, but industrial wastewater was not segregated from domestic sewage waste. Some lagoons have contained oils, paints, acids, caustics, detergents, and photographic fixer and developer. Miscellaneous drummed, solid waste materials were removed for disposal in August 1992.

Remediation activities involved the offsite disposal of about 5000 cubic yards of asbestos contaminated soil (OU-2). Remedial action for the contaminated ground water "hot spot" began in July 1999. Soil vapor extraction is the chosen remedy. The remediation pilot study for the leading edge of the ground water contamination is in operation. The remediation consists of two vertical circulation treatment wells.

- Barry M. Goldwater Range – The Barry M. Goldwater Range is a 2.7 million acre military training area in southwestern Arizona. The range has been used continuously from the 1940s to the present for military ground warfare training, aerial target practice and ground strafing. Waste and spent munitions can be found at numerous sites within the boundaries of the range. The range is under the overall management of the United States Air Force, but is divided into two management units for the Air Force and the Marine Corps. One portion (about 30% of the range) is managed by the US Fish and Wildlife Service as the Cabeza Prieta National Wildlife Refuge.

  An Installation Restoration Program by Luke Air Force Base in 1992 identified 218 possible areas of concern. Of these sites, 130 required no further action and were closed, leaving 88 areas. Forty-five of the 88 areas are active operations and are managed under state and federal Resource Conservation and Recovery Act regulations. Of the other 43 sites, additional investigations have been completed at 12 sites (two areas at the Gila Bend Auxiliary Air Field and ten sites dispersed at the former Ajo Air Station, Sentinel Navy antenna site, and various locations within the range).

  Currently, only the Ajo sites remain unresolved. Although two cleanups were performed by the Air Force at this site, small pockets of chlordane still exist at the site. ADEQ staff met with USF&WS and Luke Air Force Base on February 7, 2001 to discuss the closing out of the Ajo site. An agreement was reached between the parties on closing out the site which required some additional work by the Air Force Base. The Air Force Base is currently awaiting funding to enable them to proceed.

- Yuma Army Proving Grounds – The US Army Yuma Proving Grounds occupies 870,000 acres on the California-Arizona border north of Yuma. Its western edge is adjacent to the Colorado River. YPG was first used by the military in 1942 for training desert troops. Since that time, its mission has added testing and evaluation of a variety of military equipment including: boats, vehicles, well drilling equipment, tanks, and munitions.

  The U.S. Army has identified 19 sites where soil and ground waters samples need to be collected and analyzed to determine the nature and extent of risks posed by contaminants. The contaminants of concern include petroleum hydrocarbons, volatile and semi-volatile organic compounds, and metals. The sites were organized into four operable units based on their proximity to the main post and opportunities for rapid cleanup or similarity for cleanup.

  For some sites, data are sufficient to indicate that a remedial response is warranted. Studies are already underway at these sites to determine the appropriate response strategy. The Fuel Bladder Test Area was designated for immediate investigation by the base due to the determination that fuel in the amount of approximately 500,000 gallons may have been released at the site between 1965 and 1975. Analyses of ground water samples from monitoring wells installed during ongoing investigation of the site have shown evidence of petroleum and petroleum by-products. The effectiveness of soil vapor extraction technology was studied in 2000. At another site, the Former Waste Disposal Area, a fence to limit access to the site is being considered as an interim remedial action and an institutional control of the site.

  Reports for the remedial investigation sampling and analysis plan, for selected sites, as well as the quality assurance project plan for the Yuma Proving Ground site have been reviewed and approved by ADEQ. Initial field sampling, at some sites, has been completed. Monitoring wells are planned for the Fuel Bladder Test Area and the Former Waste Disposal Area.

Ground Water Reconnaissance Survey in Mohave County: The watersheds (Sacramento Valley, Big Sandy Valley, Detrital Valley and Hualapi Valley) are all to the south of the Colorado River – (See discussion in the Colorado Grand Canyon Watershed.)

Watershed Partnerships

Lower Colorado River Citizens Advisory Council – This advisory group primary focus is Lake Havasu pollution, including potential impacts from litter, gasoline and MTBE, septic systems, and ground water protection. The new council is developing a WRAS, identifying new partners, and working to obtain a watershed pilot grant.

Little Colorado-San Juan Watershed

LITTLE COLORADO - SAN JUAN WATERSHED CHARACTERISTICS

SIZE	26,794 square miles (24% of the State's land area).
POPULATION BASE	Approximately 236,500 people live in this watershed (estimated from the 2000 census). This is about 5% of the state's population.
LAND OWNERSHIP **(Figure 21)**	Tribal land 58%; Private land 16%; US Forest Service 11%; State land 8%; Other state and federal land 3.5%; Bureau of Land Management 2%; National Parks and Monuments 1.5%
LAND USES AND PERMITS **(Figure 22)**	Flagstaff is the largest community in this watershed. Land use on the non-tribal lands outside of Flagstaff is primarily open grazing, forestry, recreation, and mining. Major communities, tribal land, historic mining, roads and the location of facilities with NPDES discharge permits are illustrated on **Figure 22.** Land and resource preservation and conservation also occur in this watershed with four national monuments, two national forests, and four designated wilderness areas.
HYDROLOGY AND GEOLOGY	This watershed is defined by the Little Colorado River drainage area, from its headwaters to the Colorado River. The flow on the Little Colorado River is interrupted (i.e., stretches of perennial, intermittent, and ephemeral flow) (Brown et al. 1978). Just above Lyman Lake on the Little Colorado River flow varies from no flow to 16,000 cfs (in 1940), with an average annual mean of 23.5 cfs (USGS 1996). Elevations range from 2,700 feet above sea level where the Little Colorado River joins the Colorado River to 12,600 feet at Humphrey's Peak. Horizontally stratified sedimentary rocks have eroded to form canyons and plateaus. The San Francisco Mountains and White Mountains in the Mogollon Rim are igneous rocks deposited on sedimentary formations caused by recent volcanic activity. Ground water basins include: Little Colorado River Basin, with a portion of the Coconino Plateau Basin. The Little Colorado River Basin contains three stratified regional aquifers of poor water quality. The regional aquifers saturate the sedimentary formations of sandstones and limestones separated by shale and siltstone. Local aquifers are an important water source for domestic use and exist in alluvial deposits, sedimentary, and volcanic portions of the Bidahochi Formation, and various sandstones (ADWR 1994). This watershed is contained within the Plateau Highlands Hydrologic Province
UNIQUE WATERS	Lee Valley Creek, from its headwaters to Lee Valley Reservoir.
ECOREGIONS	Primarily Arizona-New Mexico Plateau, with western and southern edges in Arizona-New Mexico Mountains, and the northern fringe in Colorado Plateau.
OTHER STATES, NATIONS, OR TRIBES	This assessment does not reflect water quality on the Navajo, Hopi, and Zuni tribal lands within this watershed **(Figure 21)**. This watershed receives drainage from Utah to the north, New Mexico to the east, and Colorado to the northeast.

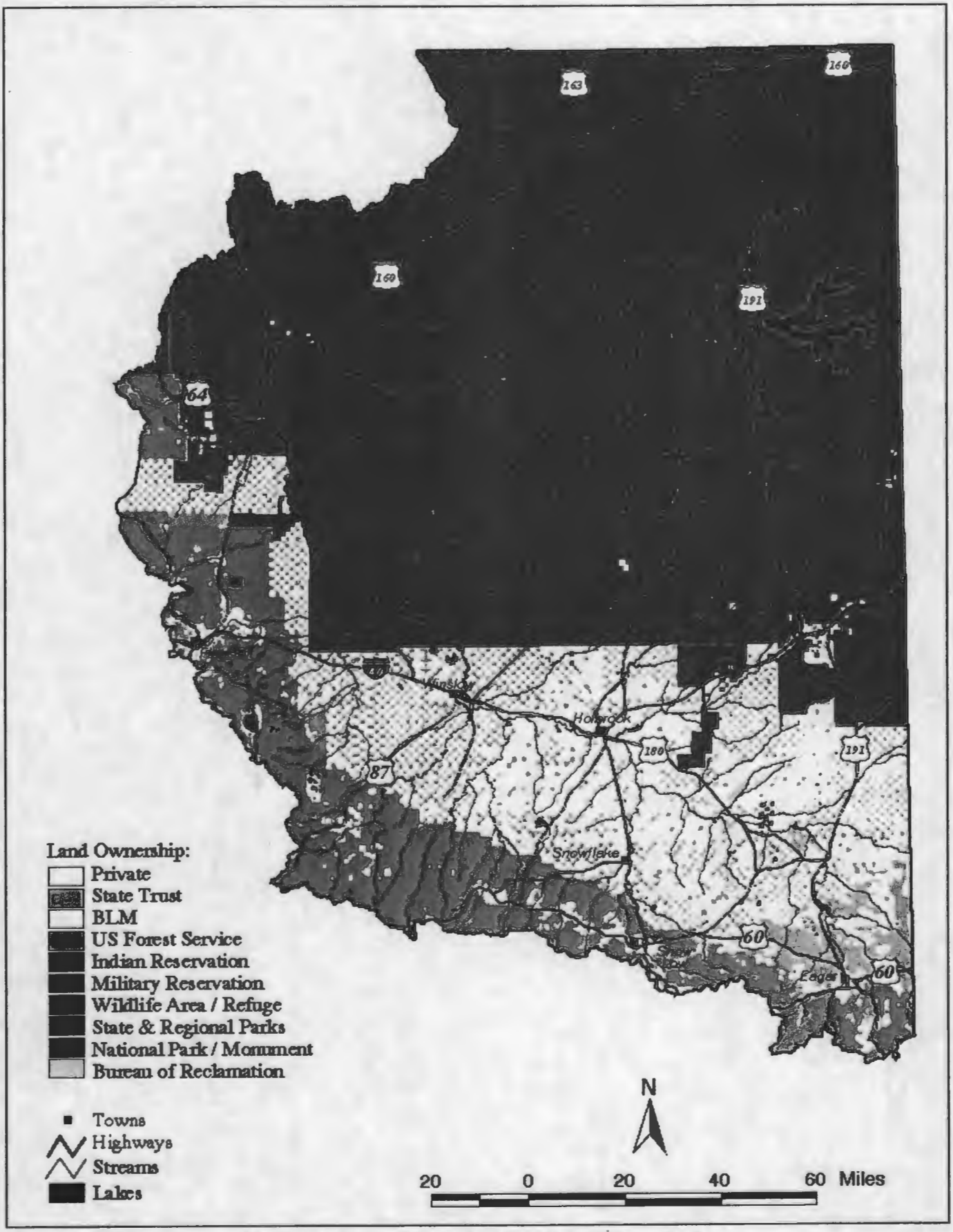

Figure 21. Land Ownership in the Little Colorado - San Juan Watershed

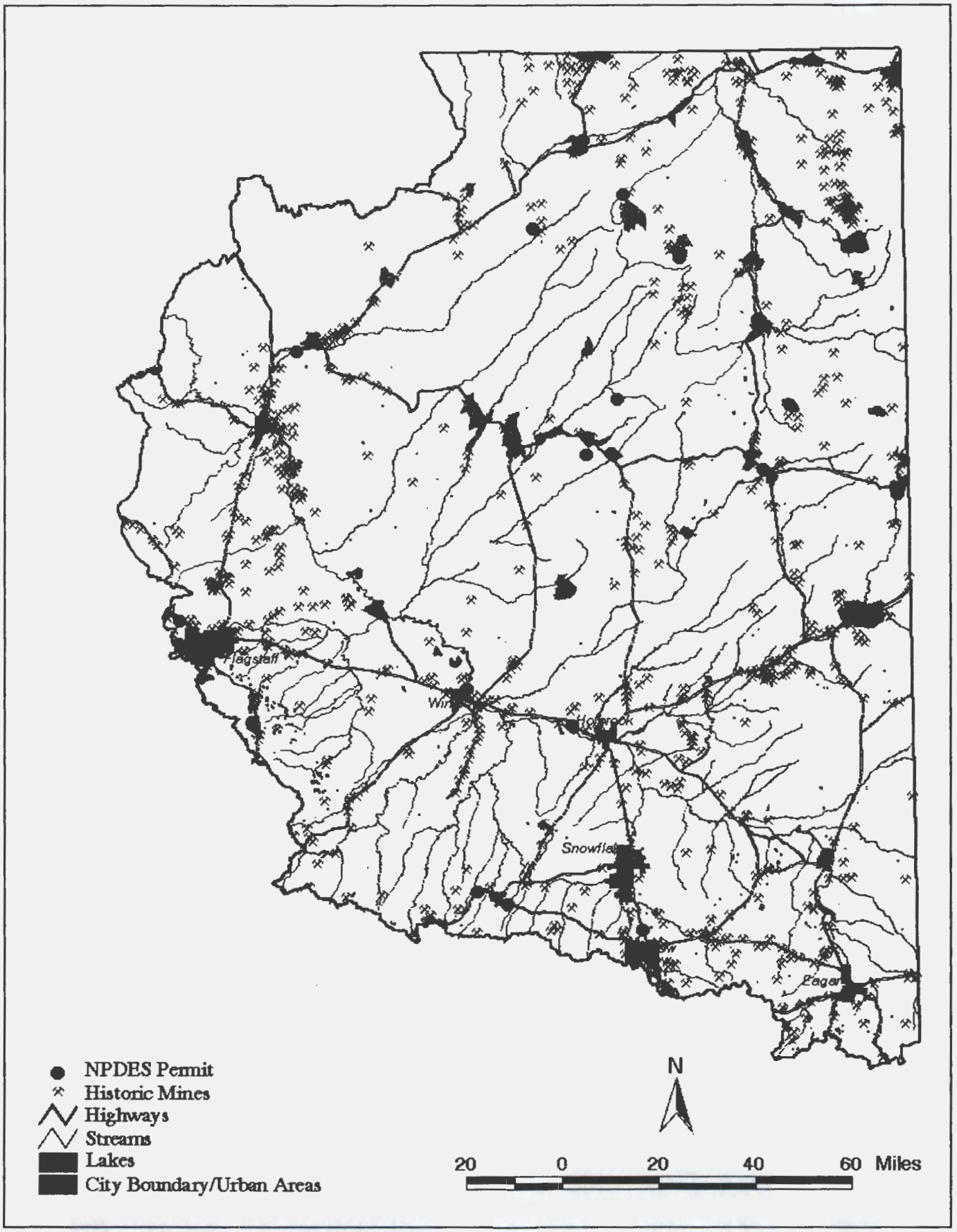

Figure 22. General Land Use and NPDES Permits in the Little Colorado - San Juan Watershed

Little Colorado-San Juan Watershed Assessment Discussion

Statistical Summary of Surface Water Assessments

Assessments – For the 2002 assessment, 250 stream miles and 2,005 lake acres were assessed. This was a focus watershed in 2001; however, this was outside the data window used for this assessment (1995-2000). That data will be applied to the next assessment.

Water quality assessment information for the Little Colorado-San Juan Watershed is summarized in the following tables and illustrated on **Figure 23**:

Table 12. Assessments in the Little Colorado-San Juan Watershed – 2002

	STREAMS		LAKES	
	miles	number of segments	acres	number of lakes
ATTAINING	127	9	159	2
INCONCLUSIVE	106	6	1,736	4
IMPAIRED	17	1	0	0
NOT ATTAINING	0	0	111	1
TOTAL ASSESSED	250	16	2,005	7

PERENNIAL SURFACE WATERS ASSESSED		STREAMS		LAKES	
		miles	number of segments	acres	number of lakes
	Assessed	241	15	2,005	7

* Note that streams with significant perennial stretches within the reach assessed were included in the perennial milage although part of the reach may have ephemeral or intermittent flow.

Inconclusive assessments – Surface waters with some monitoring data, but insufficient data to determine if the water is attaining its uses or impaired, were added to the new Planning List. By the end of the next watershed monitoring cycle (scheduled in 2005), ADEQ expects to monitor most of these reaches so that all designated uses can be assessed during the following assessment cycle.

ADEQ also will be working with USGS and the Arizona Game and Fish Department so that future monitoring will better support Arizona's surface water assessments. Other lakes and streams which lack monitoring data will also be monitored depending on resources and priorities.

Major stressors – When a surface water is listed as impaired or not attaining its designated uses, the pollutants or suspected pollutants causing the impairment are identified. Only one reach is assessed as impaired in this watershed: the Little Colorado River, from Porter Tank Draw to McDonalds Wash. This reach is impaired due to metals (copper and silver). A TMDL investigation is needed to determine the source of these metals and the contribution due to natural sources.

Rainbow Lake is assessed as not attaining its uses due to nutrient loadings causing occasional fish kills. A nutrient TMDL was approved by EPA in 2000 and is currently being implemented. The lake was added to the Planning List, and monitoring is being scheduled to evaluate the effectiveness of the TMDL implementation strategies.

Watershed assessment map

Figure 55

TABLE 13. LITTLE COLORADO - SAN JUAN WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY & PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
STREAM MONITORING DATA								
Barbershop Canyon Creek headwaters-East Clear AZ15020008-537 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program East Clear Creek confluence LCBRB000.18 100411	1996 - 1 metals 1997 - 1 suite (few metals)	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.7	1 of 1		Naturally low dissolved oxygen due to ground water upwelling. Exceedance not included in final assessment. Missing Escherichia coli.
	ADEQ Biocriteria Program At Merritt Draw LCBRB003.84 100410	1997 - 1 suite (few metals)	OK					Missing core parameters: Escherichia coli. (Note no historic or current mining in drainage area so metal samples not required.)
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	**1996-1997** **3 samples** **2 sampling events** **Missing core parameters**	**OK**				**Inconclusive**	**ADEQ's Bioassessment Program collected three water chemistry samples in 1996 - 1997. Assessed as "Inconclusive" and placed on the Planning List due to insufficient sampling events and core parameters monitored.**
Billy Creek headwaters-Show Low Creek AZ15020005-019 A&Wc, FC, FBC, AgL	AGFD Routine Monitoring At hatchery LCBIL002.81	1997 - 1 suite 1998 - 2 suites	OK					Missing core parameters: turbidity and E. coli. (Note no historic or current mining in drainage area so metal samples not required to assess.)
	Summary Row A&Wc Inconclusive FC Attaining FBC Inconclusive AgL Attaining	**1998** **3 sampling events** **Missing core parameters**	**OK**				**Attaining**	**AGFD collected three samples in 1998. Assessed as "attaining some uses" and placed on the Planning List due to insufficient core parameters.**
Buck Springs Canyon Creek headwaters-Leonard Canyon AZ15020008-557 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Inside exclosure of cattle and elk LCBCK003.81 100413	1996 - 1 suite	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	3.8	1 of 1		Naturally occurring low dissolved oxygen due to ground water upwelling. Exceednace not included in final assessment.
			pH SU	6.5-9.0 (A&Wc, FBC, AgL)	6.0-6.6	1 of 1		
			Turbidity NTU	10 (A&Wc)	19-27	1 of 1		
	Summary Row	**1996** **1 sampling event**	**pH** **SU**	**6.5-9.0** **(A&Wc, FBC, AgL)**	**6.0-6.6**	**1 of 1**	**Not assessed**	**Insufficient data to assess. Add to Planning List due to exceedances.**
			Turbidity **NTU**	**10** **(A&Wc)**	**19-27**	**1 of 1**		

TABLE 13. LITTLE COLORADO - SAN JUAN WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY & PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Chevelon Creek headwaters-West Chevelon Creek AZ15020010-006 A&Wc, FC, FBC, AgI, AgL	ADEQ Biocriteria Program At Telephone Ridge LCCHC037.39 100445	1997 - 1 suite	OK					
	AGFD Routine Monitoring @ Chevelon Crossing	1996 - 2 field, nutrients	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.0-8.3	1 of 6		Lacking turbidity, E. coli, boron, and metals
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	**1996-1997** **3 sampling events** **Missing core parameters**	**Dissolved oxygen mg/L**	**7.0 (90% saturation) (A&Wc)**	**6.0-8.3**	**1 of 6**	**Inconclusive**	**ADEQ and AGFD collected a total of 3 samples at two sites in 1996-1997. Reach assessed as Inconclusive" and placed on the Planning List due to insufficient core parameters and dissolved oxygen levels not meeting standards.**
Hall Creek headwaters-Little Colorado River AZ15020001-012 A&Wc, FC, FBC, AgI, AgL	AGFD Routine Monitoring @ Arizona Route 273	2000 - 1 field	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.1	1 of 1		
	Summary Row	**2000** **1 sampling event**	**Dissolved oxygen mg/L**	**7.0 (90% saturation) (A&Wc)**	**6.1**	**1 of 1**	**Not assessed**	**Insufficient data to assess.**
Hart Canyon Creek headwaters-Willow Creek AZ15020008-586 A&Wc, FBC, AgL	AGFD Routine Monitoring @ Vincent Ranch	1996 - 1 field, nutrients	OK					
	Summary Row	**1996** **1 sampling event**	**OK**				**Not assessed**	**Insufficient data to assess.**
Little Colorado River West Fork Little Colorado-Water Cyn AZ15020001-011 A&Wc, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Above South Fork LCR LCLCR173.84 100580	1998 - 1 suite	OK					
	Summary Row	**1998** **1 sampling event**	**OK**				**Not assessed**	**Insufficient data to assess.**
Little Colorado River Water Canyon-Nutrioso AZ15020001-010 A&Wc, FC, FBC, AgI, AgL	ADEQ Fixed Station Network At Highway 60 bridge LCLCR172.97 100333	1996 - 6 suites	Turbidity NTU	10 (A&Wc)	10-38	5 of 6		

TABLE 13. LITTLE COLORADO - SAN JUAN WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY & PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Wc Inconclusive FC Attaining FBC Attaining AgI Attaining AgL Attaining	1996 6 sampling events	Turbidity NTU	10 (A&Wc)	10-38	5 of 6	Inconclusive	ADEQ collected 6 samples in 1996. Reach assessed as "attaining some uses" and was added to the Planning List due to turbidity exceedances.
Little Colorado River Nutrioso Creek.-Carnero Wash AZ15020001-009 A&Wc, FC, FBC, AgI, AgL	ADEQ Fixed Station Below Springerville WWTP LCLCR172.60 100331	1999 - 2 suites + 1 field, nutrients 2000 - 4 suites	Turbidity NTU	10 (A&Wc)	5-45	5 of 7		
	Summary Row A&Wc Inconclusive FC Attaining FBC Attaining AgI Attaining AgL Attaining	1999-2000 4 sampling events	Turbidity NTU	10 (A&Wc)	5-45	5 of 7	Inconclusive	ADEQ collected 4 samples in 1994-2000. Reach assessed as "attaining some uses" and was added to the Planning List due to turbidity exceedances.
Little Colorado River Silver Creek.-Carr Wash AZ15020002-004 A&Ww, FC, FBC, DWS, AgI, AgL	ADEQ Fixed Station Network Near Woodruff LCLCR120.11 100334	1996 - 3 suites + 3 field + 3 nutrients 1999 - 3 suites 2000 - 3 suites	Arsenic (total) µg/L	50 (DWS, FBC)	<10 - 67	2 of 12		
			Barium (total) µg/L	2000 (DWS)	170-7,700	1 of 12		
			Beryllium (total) µg/L	0.21 (FC)	1.1-58.2	3 of 3		8 other beryllium samples were not included because Method Detection Limit was too high
			Beryllium (total) µg/L	4 (FBC)	<0.5-58.2	2 of 12		
			Chromium (total) µg/L	100 (DWS)	<10-200	1 of 16		
			Escherichia coli CFU/100 ml	580 (FBC)	30- 57,000	1 of 7		
			Fecal coliform CFU/100 ml	4,000 (DWS, A & Ww, AgI, AgL)	10 - 28,000	1 of 7		
			Lead (total) µg/L	50 (DWS)	<5-371	2 of 12		
			Lead (total) µg/L	100 (AgL)	<5-371	2 of 12		
			Manganese (total) µg/L	4,900 (DWS)	<50-9,800	2 of 12		
			Nickel (total) µg/L	100 (DWS)	<100-320	2 of 12		

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY & PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Turbidity NTU	50 (A&Ww)	30 - 1,000	8 of 11		
	Reach Summary A&Ww Inconclusive FC Attaining FBC Inconclusive DWS Inconclusive AgI Inconclusive AgL Inconclusive	1996-2000 12 sampling events.	Arsenic (total) µg/L	50 (DWS, FBC)	<10 - 67	2 of 12	Attaining	ADEQ collected 12 samples in 1996-2000. Reach is assessed as "attaining some uses" and was added to the Planning List due to beryllium, turbidity, and bacteria exceedances of standards.
			Barium (total) µg/L	2000 (DWS)	170-7,700	1 of 12	Attaining	
			Beryllium (total) µg/L	0.21 (FC)	1.1 - 58.2	3 of 3	Inconclusive	
			Beryllium (total) µg/L	4 (FBC)	<0.5-58.2	2 of 12	Attaining	
			Chromium (total) µg/L	100 (DWS)	<10-200	1 of 16	Attaining	
			Escherichia coli CFU/100 ml	580 (FBC)	30- 57,000	1 of 7	Inconclusive	
			Fecal coliform CFU/100 ml	4,000 (DWS, A&Ww, AgI, AgL)	10 - 28,000	1 of 7	Inconclusive	
			Lead (total) µg/L	50 (DWS)	<5-371	2 of 12	Attaining	
			Lead (total) µg/L	100 (AgL)	<5-371	2 of 12	Attaining	
			Manganese (total) µg/L	4,900 (DWS)	<50-9,800	2 of 12	Attaining	
			Nickel (total) µg/L	100 (DWS)	<100-320	2 of 12	Attaining	
			Turbidity NTU	50 (A&Ww)	30 - 1,000	7 of 12	Inconclusive	
Little Colorado River Lyman Lake - unnamed tributary (14 miles) AZ15020002-024 A&Ww, FC, FBC, DWS, AgI, AgL	AGFD Routine Monitoring At Wenima LCLCR158.36	2000 - 1 suite	OK					
	Summary Row	2000 1 sampling event	OK				Not assessed	Insufficient data to assess.

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Mamie Creek headwaters-Coyote Creek AZ15020001-351 A&Wc, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Below Forest Road 275 LCMAM001.73 100589	1996 - 1 suite	OK					
	Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess
Milky Creek headwaters-Nutrioso Creek AZ15020001-309 A&Wc, FC, FBC	AGFD Routine monitoring Off Nutrioso Creek	1996 - 1 field, nutrients	OK					
	Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Mineral Creek headwaters-Concho AZ15020002-648 A&Wc, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Above Forest Road #404 LCMIN014.01 100593	1996 - 1 suite	OK					
	Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess
Porter Creek headwaters-Show Low Creek AZ15020005-246 A&Wc, FC, FBC	AGFD Routine Monitoring Above Scott Reservoir LCPRT001.17	1997 - 1 field, nutrients 1998 - 2 field, nutrients	OK					Lack core parameters: turbidity and E. coli. (No historic or current mining in the drainage area, so metals are not required.)
	Summary Row A&Wc Inconclusive FC Attaining FBC Inconclusive	1997-1998 3 sampling events Missing core parameters	OK				Attaining	AGFD collected 3 samples in 1997-1998. Reach assessed as "attaining some uses" and was placed on the Planning List due to missing core parameters.
Rudd Creek headwaters-Nutrioso Creek AZ15020001-026 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Above Benton Creek LCRUD005.17 100634	1996 - 1 suite	OK					
	Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess
Show Low Creek headwaters-Linden Wash AZ15020005-012 A&Wc, FC, FBC, AgI, AgL	AGFD Routine Monitoring Above Fools Hollow and below Silver Creek LCSHL010.47	1997 - 1 field, nutrients, metals 1998 - 2 field, nutrients, metals	OK					Lacking core parameters: turbidity, E. coli, and boron. (No current or historic mining in the drainage area so metals are not required).

TABLE 13. LITTLE COLORADO - SAN JUAN WATERSHED – MONITORING DATA – 2002 ASSESSMENT

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	AGFD Routine Monitoring Above Show Low Lake	1997 - 1 field, nutrients 1998 - 2 field, nutrients	OK					
	Summary Row A&Wc Inconclusive FC Attaining FBC Inconclusive AgI Inconclusive AgL Inconclusive	**1997-1998** **6 samples** **3 sampling events** **Missing core parameters**	**OK**				**Attaining**	**AGFD collected 6 samples during 1997-1998. Reach assessed as "attaining some uses" and was placed on the Planning List due to missing core parameters.**
Sliver Creek headwaters-Show Low Creek AZ15020005-013 A&Wc, FC, FBC, AgI, AgL	AGFD Routine Monitoring @ Spring	1997 - 1 field, nutrients 1998 - 2 field, nutrients 2000 - 1 suite	OK					Missing core parameters: turbidity, E. coli, boron, metals
	AGFD Routine Monitoring @ Rock House	1997 - 1 field, nutrients 1998 - 2 field, nutrients,	OK					
	AGFD Routine Monitoring @ Upper Springs	2000 - 1 field, nutrients, metals	OK					
	AGFD Routine Monitoring @ U2 Outflow	2000 - 1 field, nutrients, metals	OK					
	AGFD Routine Monitoring @ U3 Outflow	2000 - 1 field, nutrients, metals	OK					
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	**2000** **10 samples** **4 sampling events** **Missing core parameters**	**OK**				**Inconclusive**	**AGFD collected a total of 10 samples at 5 sites in 1997-2000. Reach assessed as "inconclusive" and was placed on the Planning List because of missing core parameters.**
South Fork Little Colorado River headwaters-Little Colorado River AZ15020001-027 A&Wc, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Above So Fork Campground LCSLR001.29 100644	1998 - 1 suite	OK					
	Summary Row	**1998** **1 sampling event**	**OK**				**Not assessed**	**Insufficient data to assess.**
Walnut Creek Pine Lake-Rainbow Lake AZ15020005-238 A&Wc, FC, FBC, AgI, AgL	AGFD Routine Monitoring	1997 - 1 field, nutrients, metals 1998 - 2 field, nutrients, 1 metals	OK					Lacking core parameters: turbidity, E. coli, and boron. (No current or historic mining in the drainage area, so metals not required.)

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Wc Inconclusive FC Attaining FBC Inconclusive AgL Inconclusive	1997-1998 3 samples Missing core parameters	OK				Attaining	AGFD collected a total of 3 samples in 1997-1998. Reach assessed as "attaining some uses" and was placed on the Planning List due to missing core parameters.
West Fork Little Colorado River headwaters- Gov't Springs AZ15020001-013A A&Wc, FC, FBC	ADEQ Biocriteria Program Mount Baldy Wilderness LCWLR004.09 100694	1998 - 1 suite	OK					
	ADEQ Biocriteria Program Above Government Springs LCWLR001.08 100695	1998 - 1 suite	OK					
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive	1998 2 samples 1 sampling event	OK				Inconclusive	ADEQ collected a total of 1 samples at 2 sites in 1998. Reach assessed as "inconclusive"and was placed on the Planning List due to insufficient sampling events.
West Fork Little Colorado River Gov't Springs-Little Colorado R. AZ15020001-013B A&Wc, FC, FBC, AgI, AgL	ADEQ Fixed Station Network At Govenment Springs LCWLR000.78 100328	1996 - 6 suites 1999 - 4 suites 2000 - 4 suites	Dissolved oxygen mg/L	7.0 mg/L (90% saturation) (A&Wc)	5.0 - 8.7 (80.0 - 97.3 %)	3 of 12		Naturally occurring low dissolved oxygen due to ground water upwelling. Exceedance not included in final assessment
	Summary Row A&Wc Attaining FC Attaining FBC Attaining AgI Attaining AgL Attaining	1996-2000 14 sampling events	OK				Attaining	ADEQ collected 14 samples between 1996-2000. Reach assessed as "attaining all uses."
Willow Creek headwaters-East Clear Creek AZ15020008-011 A&Wc, FC, FBC, AgL	AGFD Rountine Monitoring @ Wiggins Crossing LCWLS	1997 - 1 field, nutrients, metals 1998 - 2 field, nutrients, metals	OK					Missing core parameters: turbidity, E. coli, dissolved metals, flow, arsenic, beryllium, mercury, manganese.
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgL Attaining	1997-1998 3 sampling events Missing core parameters	OK				Attaining	AGFD collected 3 samples in 1997-1998. Reach assessed as "attaining some uses" and was placed on the Planning List due to missing core parameters.
Willow Spring Creek headwaters-Chevelon Creek AZ15020010-240 A&Wc, FC, FBC, AgL	AGFD Routine Monitoring Below dam LCWLS003.26	1996 - 2 field, nutrients	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	1.6-5.86	2 of 2		Naturally occurring low dissolved oxygen due to ground water upwelling. Not included in final assessment. Missing core parameters: turbidity and E. coli. No mining; therefore metals not required.

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1996 2 sampling events Missing core parameters	OK				Inconclusive	AGFD collected three samples in 1996. Reach assessed as "Inconclusive"and was placed on the Planning List due to insufficient monitoring events and core parameters.
Woods Canyon Creek headwaters-Chevelon Creek AZ15020010-084 A&Wc, FC, FBC, AgL	AGFD Routine Monitoring below dam	1996 - 2 field	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.6-6.9	1 of 2		Missing most core parameters.
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1996 2 samples Missing core parameters	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.6-6.9	1 of 2	Inconclusive	AGFD collected two field samples in 1996. Reach assessed as "Inconclusive"and was placed on the Planning List due to insufficient monitoring events and core parameters.
LAKE MONITORING DATA								
Clear Creek Reservoir AZL15020008-0340 A&Wc, FC, FBC, DWS, AgI, AgL	AGFD Routine Monitoring 2 sites LCCCR	1999 - 2 field, nutrients, metals 2000 - 1 field, nutrients, metals						Lack core parameters: turbidity, E. coli, dissolved chromium, beryllium, arsenic fluoride, and barium. Mercury's method detection limit is not low enough to assess Fish Consumption.
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive AgI Inconclusive AgL Attaining	1999-2000 3 sampling events Missing core parameters	OK				Attaining	AGFD collected 3 samples in 1999-2000. Lake assessed as "attaining some uses," and was placed on the Planning List due to missing core parameters.
Cholla Lake AZL15020008-0320 A&Ww, FC, FBC, AgL	AGFD Routine Monitoring 2 sites LCCHO	1999 - 3 field, nutrients, metals 2000 - 1 field, nutrients, metals	OK					Lack core parameters: turbidity, E. coli, arsenic, and beryllium. Mercury's method detection limit is not low enough to assess Fish Consumption.
	Summary Row A&Wc Inconclusive FC Attaining FBC Inconclusive AgL Attaining	1999-2000 4 sampling events Missing core parameters	OK				Attaining	AGFD collected 4 samples in 1999-2000. Lake assessed as "attaining some uses," and was placed on the Planning List due to missing core parameters.
Lee Valley Reservoir AZL15020001-0770 A&Wc, FC, FBC, AgI, AgL	AGFD Routine Monitoring LCLEE	1997 - 1 field, nutrients 1998 - 2 field, nutrients 1999 - 1 field, nutrients	pH SU	6.5-9.0 (A&Wc, FBC, AgI) 4.5-9.0 (AgL)	6.3-10.0	2 of 4		Lack of core parameters: turbidity, E. coli, and boron. No mining in the drainage, so metals not required.
	Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	1997-1999 4 sampling events Missing core parameters	pH SU	6.5-9.0 (A&Wc, FBC, AgI) 4.5-9.0 (AgL)	6.3-10.0	2 of 4	Inconclusive	AGFD collected 4 samples in 1997-1999. Lake assessed as "Inconclusive" and was placed on the Planning List due to missing core parameters and pH exceedances.

TABLE 13. LITTLE COLORADO - SAN JUAN WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY & PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Long Lake (lower) AZL15020008-0820 A&Wc, FC, FBC, AgI, AgL	AGFD Routine Monitoring 2 sites LCLLL	1998 - 3 field, nutrients	OK					Lack of core parameter coverage: turbidity, E. coli, and boron, Lack of seasonal coverage (sampled only in summer months.) No historic or current mining in the drainage area so metals not required.
	Summary Row A&Wc Inconclusive FC Inconcluaive FBC Inconclusive AgI Inconclusive AgL Inconclusive	1998 3 sampling events Missing core parameters and seasonal coverage	OK				Inconclusive	AGFD collected 3 samples in 1998. Lake assessed as "Inconclusive" and was placed on the Planning List due to missing core parameters and seasonal coverage.
Lyman Lake AZL15020001-0650 A&Wc, FC, FBC, AgI, AgL	AGFD Routine Monitoring LCLYM	1997 - 1 field + 2 nutrients, metals 1998 - 1 nutrients	OK					Lack core parameter coverage: turbidity, E. coli, and boron, Lack of seasonal coverage (sampled only in summer months.) No historic or current mining in the drainage area so metals not required.
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	1997-1998 3 sampling events Missing core parameters and seasonal coverage	OK				Inconclusive	AGFD collected 3 samples in 1997-1998. Lake assessed as "Inconclusive" and placed on the Planning List due to missing core parameters and seasonal coverage.
McKay Reservoir AZL15020001-0007 A&Wc, FC, FBC, AgI, AgL	AGFD Routine Monitoring LCMCK	1996 - 1 field	pH SU	6.5-9.0 (A&Wc, FBC, AgI, AgL)	9.4	1 of 1		
			Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	2	1 of 1		
	Summary Row	1996 1 sampling event	pH SU	6.5-9.0 (A&Wc, FBC, AgI, AgL)	9.4	1 of 1	Not assessed	Insufficient data to assess. Added to the Planning List due to exceedances.
			Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	2	1 of 1	Not assessed	
Nelson Reservoir AZL15020001-1000 A&Wc FC, FBC, AgI, AgL	AGFD Routine Monitoring LCNEL	1997 - 1 field, nutrients 1998 - 1 field, nutrients						Lacking core parameters: turbidity, E. coli, and boron. No historic or current mining in the drainage, so metals not required.
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	1996 - 1998 2 sampling events Missing core parameters	OK				Inconclusive	AGFD collected 2 samples 1996-1998. Lake assessed as "Inconclusive" and added to the Planning List due to insufficient samples and core parameters.
Pinetop Hatchery AZL15020005-012 A&Wc, FBC, FC, AgI, AgL	AGFD Routine Monitoring LCPIN	1996 - 1 field, nutrients, metals	OK					
	Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.

TABLE 13. LITTLE COLORADO - SAN JUAN WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT								
STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY & PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Woods Canyon Lake AZL15020010-1700 A&Wc, FC, FBC, DWS, AgI, AgL	ADEQ Clean Lakes Program LCWCL	1996 - 1 suite	pH (low) SU	6.5-9.0 (A&Wc, FBC, AgL)	6.0-7.1	1 of 1		Low pH in hypolimnion of lake.
	Summary Row	1996 1 sampling event	pH (low) SU	6.5-9.0 (A&Wc, FBC, AgL)	6.0-7.1	1 of 1	Not assessed	Insufficient data to assess.

Information for interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from using AZ (for streams) or AZL (for lakes) + Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses", "Agency", and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" -- This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" -- The year and number of water samples is shown. The federal "water year is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
  - "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among samples as many different programs and agencies provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
  - "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
  - If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters
- "Standards Exceeded at this Site per Sampling Event."
  - Although many parameters may be analyzed, only those exceeding a standard are shown.
  - "OK" indicates that no standards were exceeded.
  - The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
  - "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
  - A mean or geometric mean will be shown along with the range of results if applicable to the standard.
- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or " Inconclusive." See assessment criteria in Chapter III, Volume I.

Ground Water Assessments in the Little Colorado-San Juan Watershed

Major ground water stressors – Monitoring data collected from wells in this watershed between October 1995 - October 2000 are summarized in **Table 14** and illustrated in **Figures 24, 25, and 26**. Of the 38 wells monitored, no wells exceeded Aquifer Water Quality Standards. This is a very small number of wells for this large area **(Figure 24)**

TDS concentrations -- Water quality can be characterized based on concentrations of Total Dissolved Solids (TDS) **(Figure 25)**. Elevated salinity may limit practical uses of ground water in some areas as TDS over 500 mg/L has an off-flavor (6 of the 21 wells sampled)) and TDS over 1000 mg/L will limit its use for some crops (2 of 21 wells sampled).

Due to salt deposits, salinity can be naturally very high in ground water. Human activities such as mining, irrigated agriculture, and even wastewater disposal practices can also raise the natural level of salinity in ground water.

No TDS water quality standards apply in this watershed, and the elevated levels of TDS do not present a human-health concern for drinking water. The TDS concentration is only used to generally characterize water quality.

Nitrate concentrations – Water quality can also be characterized by looking at the concentration of nitrates in ground water **(Figure 26)**. In Arizona, naturally occurring nitrate concentrations in ground water are generally below 3 mg/L and concentrations above 5 mg/L may indicate potential anthropogenic sources of nitrate. Among the 36 wells monitored, all nitrate concentrations were below 5 mg/L, indicating high quality water.

When a nitrate concentration exceeds 10 mg/L, Arizona's Aquifer Water Quality Standard has been exceeded. This standard was set to protect human health ,as water with nitrate greater than 10 mg/L may present a health problem for babies and should not be consumed by nursing mothers. No wells exceeded this standard in this watershed; however, efforts should be made to minimize further contamination of ground water by nitrates.

Table 14. Little Colorado-San Juan Watershed Ground Water Monitoring 1996 - 2000

MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	2		0	0%
	Fluoride	3		0	0%
	Metals/Metaloids	3		0	0%
	Nitrate	3		0	0%
	VOCs + SVOCs*	0	–	–	--
	Pesticides	0	–	–	--
TARGETED MONITORING WELLS	Radiochemicals	13		0	0%
	Fluoride	31		0	0%
	Metals/metaloids	32		0	0%
	Nitrate	33		0	0%
	VOCs + SVOCs*	3	0	0	0%
	Pesticides	3	0	0	0%

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells (all targeted wells)	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
21	15	4	1	1

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells (only 3 index wells)	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
36	36	0	0

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.
The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.

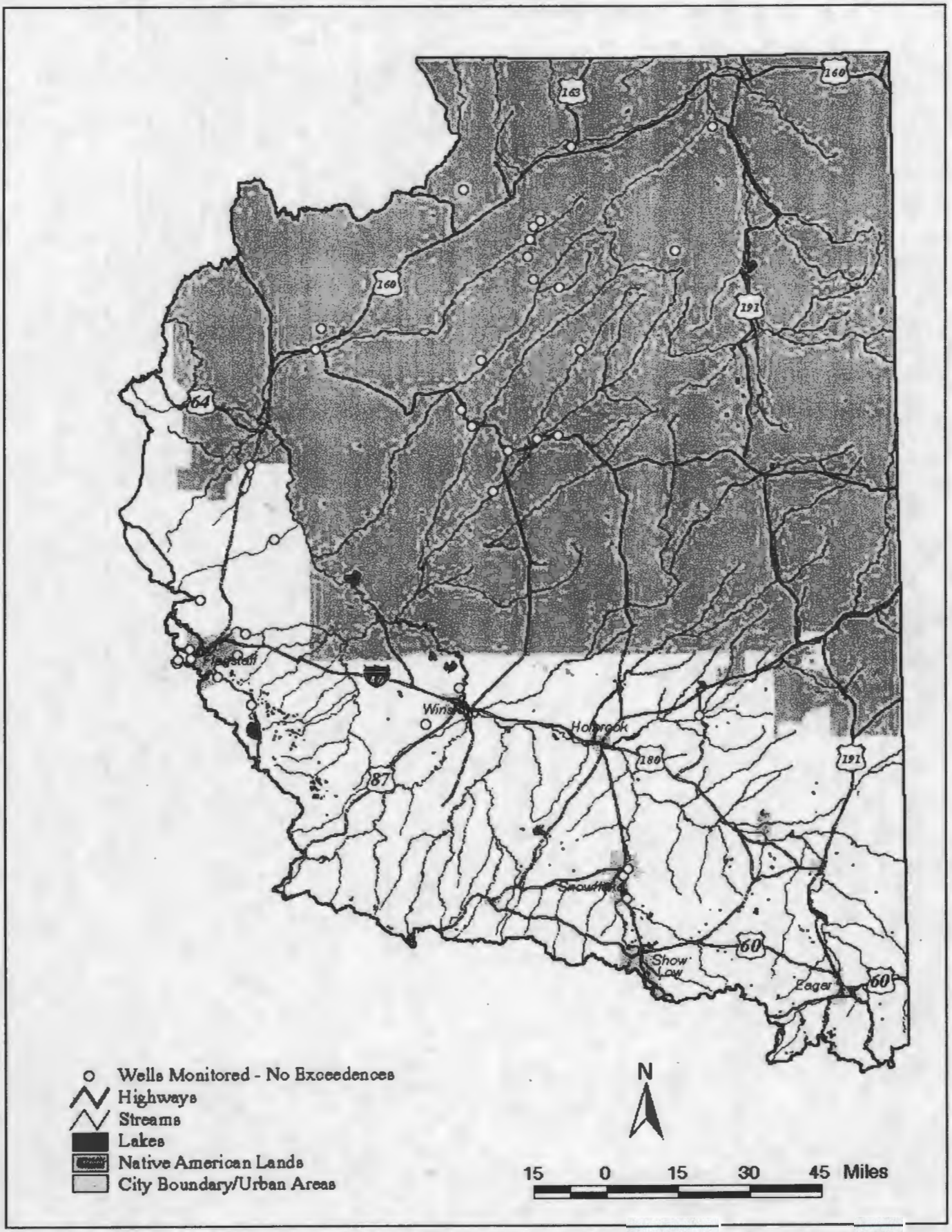

Figure 24. Ground Water Monitoring in the Little Colorado-San Juan Watershed – 1996-2000

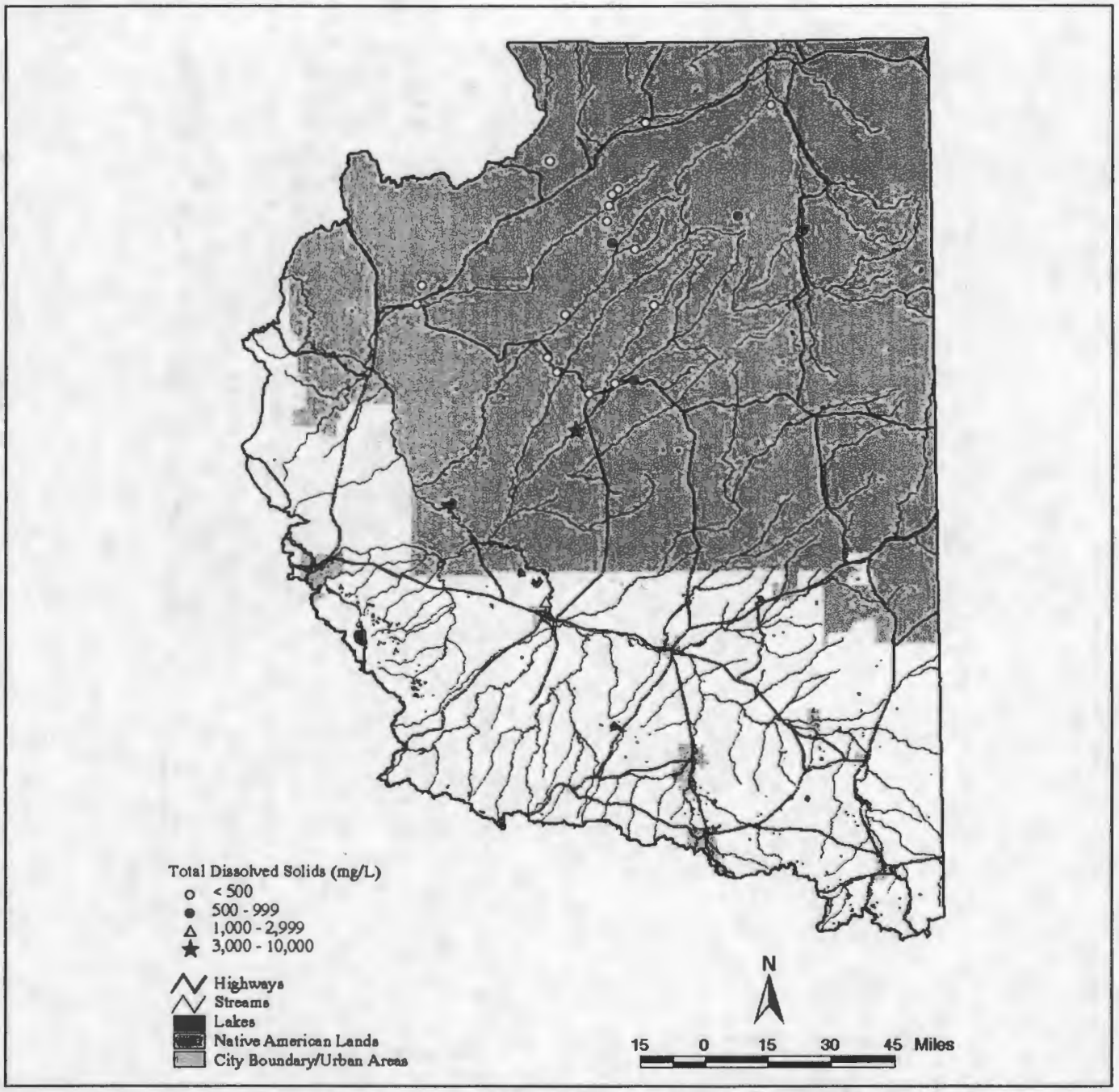

Figure 25. Classification of Ground Water Quality by TDS Concentration in the Little Colorado - San Juan Watershed

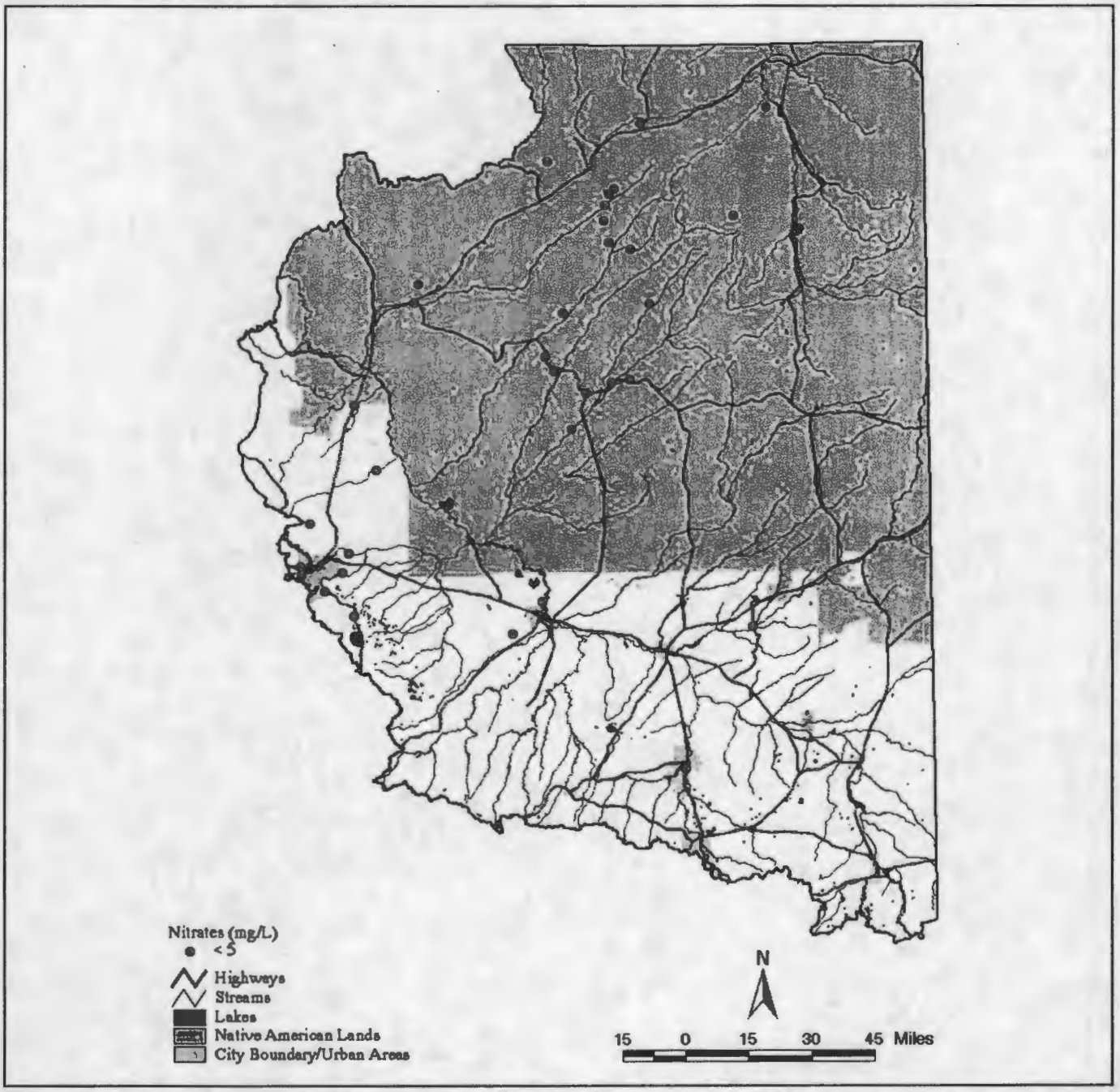

Figure 26. Classification of Ground Water Quality by Nitrate Concentration in the Little Colorado - San Juan Watershed

Watershed Studies and Alternative Solutions In the Little Colorado - San Juan Watershed

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the Little Colorado-San Juan Watershed. Watershed partnerships active in this watershed are also mentioned.

Surface Water Studies and Mitigation Projects

Total Maximum Daily Load Analyses – The following TMDL analyses have been completed or are ongoing in this watershed. Further information about the status of these investigations can be obtained by contacting the TMDL Program manager at (602) 207-4468, or at ADEQ's web site: http://www.adeq.state.az.us/environ/water/assess.

- Nutrioso Creek TMDL – In 2000, EPA approved a Total Maximum Daily Load analysis on Nutrioso Creek for turbidity completed by ADEQ. The study determined that a seven mile section, extending from approximately two miles north of the Town of Nutrioso to Nelson Reservoir, violated the current turbidity standard of 10 NTU. Field investigations indicate that entrenchment and increased turbidity levels occurred primarily due to historic grazing and forestry practices in the watershed. Historic and current ungulate grazing has contributed to a loss of riparian vegetation which would help stabilize banks, dissipate stream energy, and slow stream velocities. The entrenchment of the stream caused a loss of flood plain, which leads to further increased stream velocity and related shear stress at bankfull and higher flows. The soils are primarily composed of a silty organic clay which are highly susceptible to waterborne erosion, freeze-thaw erosion, and wind erosion.

  The target load capacity for Nutrioso Creek to meet water quality standards during critical spring flows was calculated to be 183 pounds per day as total suspended solids (TSS), while the measured load was estimated to be 1020 pounds per day. Therefore, the load reduction was calculated to be 837 pounds of TSS per day. During average base flow conditions no load reduction is necessary as no violations occur.

  As turbidity impairment is correlated with increased flows in critical spring flow events, implementation projects and best management practices were designed reduce stream water velocities during these higher flows, and thereby, decrease sediment loads from sheet flow and wind erosion. A variety of Best Management Practices (BMPs) and other possible projects were identified in the TMDL, including:

  - Limiting cattle grazing in the riparian corridor to only the dormant winter months to encourage a diversity of emergent plants in the spring.
  - Reduced timber cutting on US Forest Service lands;
  - Close 40 miles of roads on US Forest Service lands (completed 1999);
  - Adjust cattle entry times and balance the number of cattle with the allowable use by 2005;
  - Establish cattle and wildlife exclosures where overgrazing has been a problem during critical growing periods;
  - Install stream grade stabilization structures to protect at risk banks during high critical flow events;
  - Encourage off-channel cattle and wildlife drinking facilities to allow more water to remain in the stream and allow the riparian corridor to encourage revegetation;
  - Revegetate riparian corridors with willow planting and grasses using a critical Area Planing method outlined by the Natural Resources Conservation Service guidance.

- Rainbow Lake TMDL – In 2000, EPA approved the Rainbow Lake nutrient TMDL for Rainbow Lake. Based on nutrient load reductions and projections for associated indicators, the standards for pH, ammonia toxicity, and narrative nutrients will be achieved.

  Within the Rainbow Lake watershed there are no permitted point sources on nutrients; therefore, non-point sources must be controlled to eliminate harmful eutrophic conditions in Rainbow Lake. Several nonpoint sources of nutrients were identified: septic systems, ground water, decomposition of aquatic plants, and runoff from residential, commercial, agricultural, forests, and barren land. Based on historic nutrient budgets the following load reductions from non-point sources are needed to achieve water quality standards (non-dredging option):

Nitrogen Reduction	Phosphorus Reduction
residential runoff – 50%	residential runoff – 50%
macrophyte decomposition – 50%	macrophyte decomposition 50%
septic systems – 75%	

Implementation options were discussed in the TMDL. ADEQ recommended a strong monitoring effort in the lake and its tributaries to gauge the success of implemented strategies.

- Little Colorado River TMDL – ADEQ initiated a turbidity TMDL in the upper Little Colorado River in 2000. Information about the status of this TMDL and opportunities for public involvement can be found at ADEQ's web site: http://www.adeq.state.az.us.

Water Protection Fund projects – The following Water Protection Funds projects have been awarded grants by the Arizona Department of Water Resources.

- Saffell Canyon and Murray Basin (Sub-)Watershed Restoration Project – Apache Sitgreaves National Forest received this grant to restore watershed health and improve water quality water quality in these drainage areas by reducing and reversing soil erosion in the watershed. The Murray Basin and Saffell Canyon had been severely damaged by past management practices. Project was completed in 1998.

- Hoxworth Springs Riparian Restoration Project – Scientists at Northern Arizona University are working with the Coronado National Forest to restore the historic stream channel to a portion of a perennial stream that flows from Hoxworth Springs. The stream has experienced downcutting and a significant loss of riparian vegetation due to channelization and intense grazing from livestock and elk. Channel stabilization is to be accomplished using earth moving equipment and revegation. Elk exclosures were constructed to reduce grazing pressure during restoration efforts. This project was completed in 1999.

- Highpoint Well Project – Navajo County Natural Resource Conservation District developed 24 water troughs and 3.5 miles of cross fencing to more evenly distribute grazing by livestock and wildlife (ungulates). The objective is to improve vegetative cover; thereby reducing erosion and sediment deposition in both Chevelon Creek and Clear Creek, which are perennial tributaries to the Little Colorado River. This project was completed in 1999.

- Talastima (Blue Canyon) Sub-watershed Restoration Project – The Hopi Tribe received funds to restore the Talastima subwatershed, which contains almost 8,000 acres with 19 miles of stream and wetlands on the Hopi lands. Restoration measures included:

  - A tamarisk and Russian olive tree removal demonstration project,
  - Revegetation of native wetland and riparian species,
  - Erosion control using straw bales,
  - Completing livestock exclosures with fencing,
  - Installation of a monitoring well and seven drive-point wells,
  - A study of road impacts on riparian health.

  Monitoring was conducted using on-the-ground data collection combined with remote sensing techniques to evaluate the success of tamarisk and Russian olive removal and revegetation to improve ground water levels, surface water flows, water quality, and migratory bird habitat. This project was completed in 2001

- Tsaile Creek (Sub-)Watershed Restoration Demonstration – The Navajo Nation received a grant to develop six watershed restoration projects with concurrent workshops to demonstrate riparian restoration concepts to local residents, tribal employees, and resource conservation professionals. The projects focused on biological restoration approaches and was completed in July 2000.

- Demonstration Enhancement of Pueblo Colorado Wash at Hubbell Trading Post – The National Park Service (Hubbel Trading Post National Historic Site) was funded to re-establish, enhance and conserve one-half file of the Pueblo Colorado Wash within the boundaries of this historic site. The stream channel was restored using low-tech instream structures to restore meanders and pools. This should slow stream flows so that sediment is deposited in point bars that will eventually support riparian vegetation. Invasive plant species were removed from the riparian area. The stream channel and riparian areas were revegetated with appropriate native species such as native reed, willows and cottonwoods. Restoration efforts and water quantity were

evaluated to determine changes that result from project activities. Hydro-meteorological monitoring was conducted to establish hydrological baseline data for the wash. The project was completed in 2001.

- EC Bar Ranch Water Well Project – James Crosswhite, a rancher, received funds to develop an alternative water source for livestock and wildlife in order to eliminate the need for the animals to utilize a water gap in the fenced section of Nutrioso Creek, a degraded perennial stream. This objective will be met through the drilling of two water wells, installation of solar pumps, and distribution of water to tanks. The project is to be completed in 2002.

- EC Bar Ranch Wildlife Drinker Project – Funds were also provided to James Crosswhite to establish four wildlife (elk) drinking water sources along the west and east sides of Nutrioso Creek in order to deter elk from using the creek and impacting the riparian vegetation. Livestock management of the area has recently been improved by the addition of upland water sources and livestock fencing. Livestock will continue to use the riparian area under a management plan formulated in conjunction of the Natural Resources Conservation Service. Project funding will be used to purchase and install conveyance pipe, drinkers, and more at four sites with water to be provided from a well previously developed using Water Protection Funds. The project is to be completed in 2003.

- Watershed restoration of a High Elevation Riparian Community – This project, conducted by Northern Arizona University, is to increase and sustain water flows into the unhealthy down slope riparian community at Hart Prairie in Northern Arizona. Previous riparian restoration work at this site improved moisture conditions by successfully increasing surface discharge and ground water storage; however, monitoring results indicate incomplete recovery due to up slope watershed conditions. The following work is aimed at improving water flows:

  - Reduce the density of pines encroaching the wet meadow by tree thinning and prescribed burns,
  - Construct fencing to manage grazing of large ungulates,
  - Reduce or eliminate stock tanks,
  - Restore stream channels in the upland watershed,
  - Continue and expand monitoring of the watershed vegetation, stream flow, and fluvial geomorphology.

- Pressure Irrigation Feasibility Study and Preliminary Design – The Town of Eager and Round Valley Water Users Association received funds to conduct a feasibility study and preliminary design for making improvements to the irrigation system. Improvements to the irrigation system can potentially enhance the water quality and quantity of water in storage. Irrigation water is currently delivered through unlined open ditch canals, and extremely high water losses occur through percolation. These losses result in more water being diverted from the Little Colorado River. This study identified the extent of the water loss in the current irrigation ditch and canal system, and provided a preliminary design for the most feasible methods to resolve these water losses. Implementation of potential recommendations from this study could enhance riparian habitats along the Colorado River. (An ADEQ Water Quality Improvement Grant was also awarded to pipe the first five miles of the Big Ditch.) This project was completed in 2001.

- Little Colorado River Enhancement Demonstration Project – The Apache Natural Resources Conservation District was awarded funds to develop a site-specific concept plan and construct a river restoration demonstration project on a reach of the upper Little Colorado River on private land. The project will incorporate a natural channel approach that will demonstrate an effective means for restoring a destabilized stream channel. The Upper Little Colorado River Partnership hopes to establish a demonstration project that will educate other landowners and natural resource managers about stream and riparian restoration techniques. This restoration project will be used as an outdoor classroom for looking at aquatic and riparian systems, biology , and domestic livestock and wildlife interactions. The projected is to be completed by 2003.

- Little Colorado River Riparian Restoration Project -- The Pueblo of Zuni seeks to restore a working riparian area and wetland ecosystem along the Little Colorado River in Hunt Valley. The project would involve testing and reconditions an existing well and constructing a pipeline to an areas that would restore three wetlands and 80 acres of riparian habitat. The tribe is committed to maintaining the project in perpetuity and has obtained matching funding from the US Bureau of

Reclamation and the US EPA for monitoring efforts. This project is to be completed by 2003.

- Brown Creek Riparian Restoration – Apache-Sitgreaves National Forest Lakeside Ranger District received funds to establish one livestock watering facility, create a baseline inventory, and monitor a perennial segment of Brown Creek. The project area includes the spring and 1.5 miles of the upper portion of Brown Creek, one of a few perennial streams in this district.

Water Quality Improvement Grant Projects – ADEQ awarded the following Water Quality Improvement Grants (319h Grants) in this watershed.

- EC Bar Ranch Turbidity Reduction Project – Phase I and II – Jim Crosswhite, a private rancher, is to demonstrate the effectiveness of various practices recommended in the Nutrioso turbidity TMDL, such as adding riparian area fencing and installing off-channel water wells to remove cattle from riparian area. By doing this Mr. Crosswhite hopes to reestablish a properly functioning riparian corridor and eventually recondition Nutrioso Creek so that it meets its turbidity standard and TMDL goals.

- Overgaard Townsite Water Protection Project – The Overgaard Domestic Wastewater Improvement District plans protect surface and ground water that is presently threatened by an abandoned and failed onsite community wastewater disposal system. Twenty households are presently hooked up to the system, and when functioning, the system consists of a 10,000 gallon septic tank and leach field located on a one-acre parcel just north of the subdivision. Repair of the system is necessary to protect public health, the underlying ground water aquifers, and nearby streams.

- Murray Basin-Saffel Canyon Phase II -- The U.S. Forest Service is to improve two severely degraded areas in tributaries to Nutrioso Creek, by reducing current erosion processes and restore channels to their natural form and function. The Forest Service also plans to realign and upgrade some roads, obliterate some roads and two-track vehicle paths, and revegetate disturbed sites. The project will be implemented directly upstream of Nutrioso Creek, which is currently on the state's 303(d) list of impaired surface waters due to turbidity.

- Rogers Ranch Turbidity Reduction Project – This project focuses on reducing turbidity in Nutrioso Creek by restoring exposed stream banks and increasing vegetation growth using riparian fencing, off-channel water wells, and keeping water caps closed during the growing season.

- Upper Little Colorado River – Big Ditch Water Lass and Water Quality Improvement Project – Water on the Little Colorado River is diverted into the "Big Ditch" approximately six miles upstream of the town of Eagar. Eager plans to line the ditch with an impervious liner to cure the leakage now occurring in the ditch. This actions is to improve water quality by enhancing riparian growth and by increasing flows in the Little Colorado River.

Water Augmentation -- In 1999, researchers from the University of Arizona, with funding from the Arizona Rural Watershed Initiative, began water augmentation studies. Studies include looking at possible watershed management practices that might lead to increased runoff, and determining the feasibility of weather modification through precipitation patterns.

East Clear Creek Strategy Watershed Recovery Plan for the Little Colorado Spinedace and Other Riparian Species – This strategy was developed in coordination with various agencies responsible for managing habitat, activities, and wildlife resources to identify those activities that will assist in the recovery of the Little Colorado spinedace (a species federally listed as "threatened") and its habitat within the East Clear Creek drainage area. The strategy suggested management actions common to the entire watershed to substantially reduce both the direct and indirect impacts of recreation, roads, livestock and elk grazing, and predatory aquatic species on the spinedace. These strategies will also benefit other riparian species. These strategies include:

- Remove or reduce introduced fish and crayfish;
- Survey spinedace locations, identify problems associated with recreation, road locations and use, livestock management, timber harvesting, and sport fish management, and develop solutions to these problems through the National Environmental Protection Act process.
- Provide supplemental stocking of spikedace in perennial stretches to restore depleted populations;
- Pursue agreements and in-stream flow water rights to maintain stream flow in major tributaries and aquaducts; and ensure that the needs of aquatic species are considered in current and future water rights

discussions.

- Manage elk and livestock to prevent degradation or improve meadows and riparian areas (e.g., exclosures, monitor watershed conditions, recommend population densities in line with natural habitat fluctuations due to rainfall).
- Take actions to restore and maintain riparian functioning condition and mimic historic flows (e.g., manage habitat for riparian species, planting and seeding, restrict or eliminate vehicles in meadows and riparian areas, reduce or eliminate camping in meadows);
- Evaluate roads and close/remove unneeded roads, relocate problem roads, and encourage the use of roads that do not negatively impact areas. Designate areas for off-road vehicles, and direct camping to specific areas.
- Educate and inform the public concerning these strategies.

The plan recommends specific actions for stream reaches and lakes within this drainage area and a prioritized implementation schedule. An annual report will evaluate whether actions are being accomplished and report on the effectiveness monitoring.

Further information concerning this report and strategy implementation can be obtained by contacting the US Fish and Wildlife Service or the Arizona Game and Fish Department.

Ground Water Studies and Mitigation Projects

Fort Valley Study -- ADEQ completed a ground water quality study in the small community of Fort Valley to look at possible impacts of septic systems on perched aquifers in the area. Samples were collected in 1993, 1994, and 1995 during varied climatic conditions – dry and wet seasons – to determine whether permanent or temporary ground water quality issues occurred due to septic systems.

From this study, ADEQ made the following conclusions and recommendations:

- The minimal extent of ground water contamination by septage-indicator parameters (e.g., nutrients, bacteria, total dissolved solids, chloride, sulfate) does not warrant recommending replacing currently installed septic systems with alternative wastewater disposal systems. However, caution should be exercised in selecting appropriate locations and types of additional systems and the operation of current systems.
- During periods of heavy precipitation, when ground water levels rise due to recharge, it would be prudent to dispose of wastewater by pumping septic tanks rather than allowing the septic effluent to possibly leach through saturate soil which would fail to provide proper filtration.
- It would be prudent for home owners to subject their septic tanks to a tightness test to determine if their septic systems were operating properly.
- To avoid ground water contamination, only alternative onsite wastewater treatment systems, designed by an engineer, should be used were the soil is rated as "unsuitable for use as a leach field" by the Natural Resources Conservation Service (shallow ground water). These systems must conform to ADEQ's Engineering Bulletin #12 and be approved for use by the county health department.
- Shallow perched aquifers (e.g. less than 15 feet below land surface, should be avoided as domestic water sources. Wells going through these perched aquifers should be properly sealed to exclude the entry of shallow or surface water.

This report was published in 1995. Further information can be obtained from Douglas Towne at (602) 207-4412 or e-mail him at dct@ev.state.az.us.

Black Mesa Study – The Navajo Nation and Hopi Tribe of the Black Mesa area, Arizona depend on ground water to meet most tribal and industrial needs. Increasing use of this aquifer is creating concerns about adverse effects of withdrawals on the water resources of this region. The US Geological Survey (USGS) conducted a study of recharge rates and hydraulic conductivity of the aquifer to provide a conceptual model of ground water flow and to estimate recharge rates and hydraulic conductivity.

Adjusted radiocarbon data indicates that more than 90 percent of the water in the aquifer is older than 10,000 years and was recharged during glacial periods. In some areas, the ground water was more than 35,000 years old. Hydrologic conductivities (movement of water in the soil) is estimated at from 0.05 to 2.1 feet per day, averaging 0.65 feet per day.

Copies of this investigation can be obtained from the USGS office in Tucson, Arizona (USGS Water Resources Investigation Report number 96-4190 -- Lopes and Hoffman, 1997).

Watershed Partnerships

Three watershed partnerships are working on water quantity and water quality concerns in the Little Colorado River-San Juan Watershed.

The Little Colorado River Multiple Objective Management (LCR-MOM) – This group uses a multi-objective management strategy which balances environmental and economic concerns to address all of this watershed's concerns -- flooding, sedimentation, stream form and function restoration, water conservation, recreation and tourism, irrigation systems and more. LCR-MOM provides an opportunity for citizens, businesses, and communities to establish a voluntary collaborative approach to enhancement of the quality of life within the watershed. It has identified the following major goals along with specific objectives and actions to accomplish each of them:

- Broaden people's knowledge of and involvement in the LCR-MOM planning process;
- Improve information and technology transfer on its resources;
- Sustain economic growth of the natural resources industry;
- Enhance the quality of live;
- Reduce risk and economic impacts from flood and other natural disasters;
- Increase proper function characteristics of the river systems;
- Enhance recreational opportunities;
- Preserve the cultural heritage;
- Maintain and improve water quality for all uses;
- Increase opportunities for conservation and multiple use of water resources;
- Improve watershed and stream function to promote diverse, stable, and productive wildlife and fish habitat; and
- Enhance networking among individuals, agencies, and organizations with an interest in this watershed.

The LCR-MOM holds regularly scheduled workshops and meetings. To obtain further information you can contact a representative at (520) 524-6063, extension 5 or http://www.littlecolorado.org.

The Upper Little Colorado River Watershed Partnership – The partnership has identified the following as goals:

- Water quantity conservation -- Conserve surface and ground water by:
  a. improving irrigation efficiency through replacing open ditches with lined channels and pipes, minimizing irrigation water run-off;
  b. evaluate the use of low water use crops where possible; and
  c. evaluate the possibility of water augmentation through watershed management and weather modification, both winter snow and summer rain.
- Conserve ground water resources -- Substitute surface water for ground water, where possible, to help maintain and eventually raise ground water levels. Quantify ground water levels and pumping. continue monitoring pumping, ground water levels, and drawdown.
- Water quality protection and improvement -- Improve surface water quality by:
  a. reducing stream bank erosion;
  b. coordinating restoration and enhancement efforts;
  c. providing alternative wildlife and stock water sources;
  d. extend sewer infrastructure to outlying areas, eventually eliminating septic tanks and leach fields to improve ground water quality;
  e. evaluate the use of treated sewage effluent for pasture, golf courses, wildlife habitat, etc;
  f. evaluate the feasibility of combining the sewage collection and treatment systems of Springerville and Eager; and
  g. evaluate the feasibility of silt removal from Lyman Lake and sediment storage on Coyote Creek.
- Land and resource conservation – Encourage the continued implementation of various conservation measures such as:
  a. Improve grazing management practices such that the watershed will sustain natural vegetation, thus improving habitat and water quality. This includes fencing to improve grazing management and providing off-stream drinking water facilities for wildlife and livestock;
  b. Install erosion and sediment control structures where needed;
  c. Develop proper timber management practices including small diameter logging to increase water yield, maintain a continuous supply of wood fiber and reduce erosion, prevent wildfires through "controlled burning" practices.
  d. Protect and enhance threatened and endangered species habitat; protect and enhance habitat for wildlife and flora; protect and develop wetlands;
  e. Evaluate and develop recreational opportunities (fishing hunting, access to surface waters, wildlife viewing, and trails for hiking,

equestrian, and off-road vehicles).

- Public Outreach -- Hold meeting to make the public aware of activities and future projects. Develop a web site. Support a local education center and develop demonstration areas and outdoor classrooms.

A steering committee is composed of local communities, water user groups, the Hopi Tribe, Apache County, and local citizens with technical support from state and federal agencies.

The Nutrioso Creek Watershed Partnership – This work group was formed in 1998 to provide oversight for implementation projects and plans, and may provide additional data in the form of volunteer monitoring of Nutrioso Creek. This partnership is officially represented at the Upper Little Colorado River Watershed Partnership meetings. This work group maintains a website with information about the 319 funded projects on Nutrioso Creek at Jim Crosswhite's E.C. Bar Ranch at http://www.ecbarranch.com. It also provides information about grant writing, funding sources, and more that may be useful to other partnerships.

Middle Gila Watershed

MIDDLE GILA WATERSHED CHARACTERISTICS						
SIZE	12,249 square miles (11% of the state's land area).					
POPULATION BASE	Approximately 3, 190,700 people live in this watershed (estimated from the 2000 census). This is more than 60% of the state's population.					
LAND OWNERSHIP **(Figure 27)**	Private land	27%	US Forest Service	10%	Other state and federal	4.5%
	Bureau of Land Management	26%	Tribal Land	6%	Military land	3.5%
LAND USES AND PERMITS **(Figure 28)**	The Phoenix metropolitan area is located in this watershed. Until 20 years ago, irrigated agriculture was the primary land and water use in the greater Phoenix area; however, this use is being displaced by rapid urbanization. Outside the urbanized area, livestock grazing is the primary land use. Abandoned mines occur across this watershed but are more concentrated in the Prescott Mining Area.					
HYDROLOGY AND GEOLOGY	This watershed is defined by the Gila River drainage area below Coolidge Dam (San Carlos Reservoir) in the east to Painted Rock Dam in the west, excluding the Santa Cruz River and San Pedro River drainages and the Salt River above Granite Reef Dam. The Salt River drainage area below Granite Reef Dam is included in this watershed, instead of in the Salt Watershed, because the water in the Salt River normally is diverted at Granite Reef Dam into a system of canals and becomes hydrologically disconnected from its natural fluvial system. Several distinct surface water sub-basins can be identified in this watershed: Gila River, lower Salt River, Agua Fria River, and Hassayampa River. Surface water diversions and ground water pumping for agricultural and urban uses have left stream beds in the Phoenix area dry. The basin receives limited rainfall; therefore, surface water flow in this basin is primarily attributable to occasional releases from upstream impoundments, effluent from wastewater treatment plants, and agricultural return flows (Brown et al. 1978). The flow in the Gila River above Gillespie Dam, near the downstream extent of this watershed, varies from less than 5 cfs (in 1966) to an estimated 130,000 cfs (in 1993) during a major flood event (USGS 1996). Several ground water basins are included in this watershed, including: Agua Fria, Donnelly Wash, Dripping Springs, Gila Bend, Harquahala Valley, McMullen Valley, Phoenix Active Management Area (AMA), Tiger Wash, and Upper Hassayampa basins, along with portions of the Bill Williams and Lower San Pedro basins, Prescott AMA, and Pinal AMA. The main water-bearing unit is the basin-fill deposits which are found in valleys between the mountains. These deposits of gravel, sand, silt, and clay may yield several hundred gallons per minute to wells. In the mountains, small yields of ground water are obtained from thin alluvial deposits and/or fractured bedrock. (ADWR 1994) The Basin and Range is the primary Hydrologic Province, with only a relatively small portion extending into the Central Highlands Province. The Basin and Range area is characterized by gently-sloping alluvial plains, separated by mountain ranges that trend to the north and northwest.					
UNIQUE WATERS	None					
ECOREGIONS	Primarily Southern Basin and Range, with the northeastern edge in the Arizona-New Mexico Mountains.					
OTHER STATES, NATIONS, OR TRIBES	This watershed receives drainage from the upper Gila River, the San Pedro River, the Santa Cruz River, the Salt River, and the Verde River. Theoretically it discharges to the Colorado Lower Gila; however, after the dam and related diversions were constructed at Painted Rocks water has flowed past Painted Rocks Borrow Pit Lake only during a major flood in 1993. Salt River, Fort McDowell, Gila Bend, and Gila River Indian communities are significant stakeholders within this watershed.					

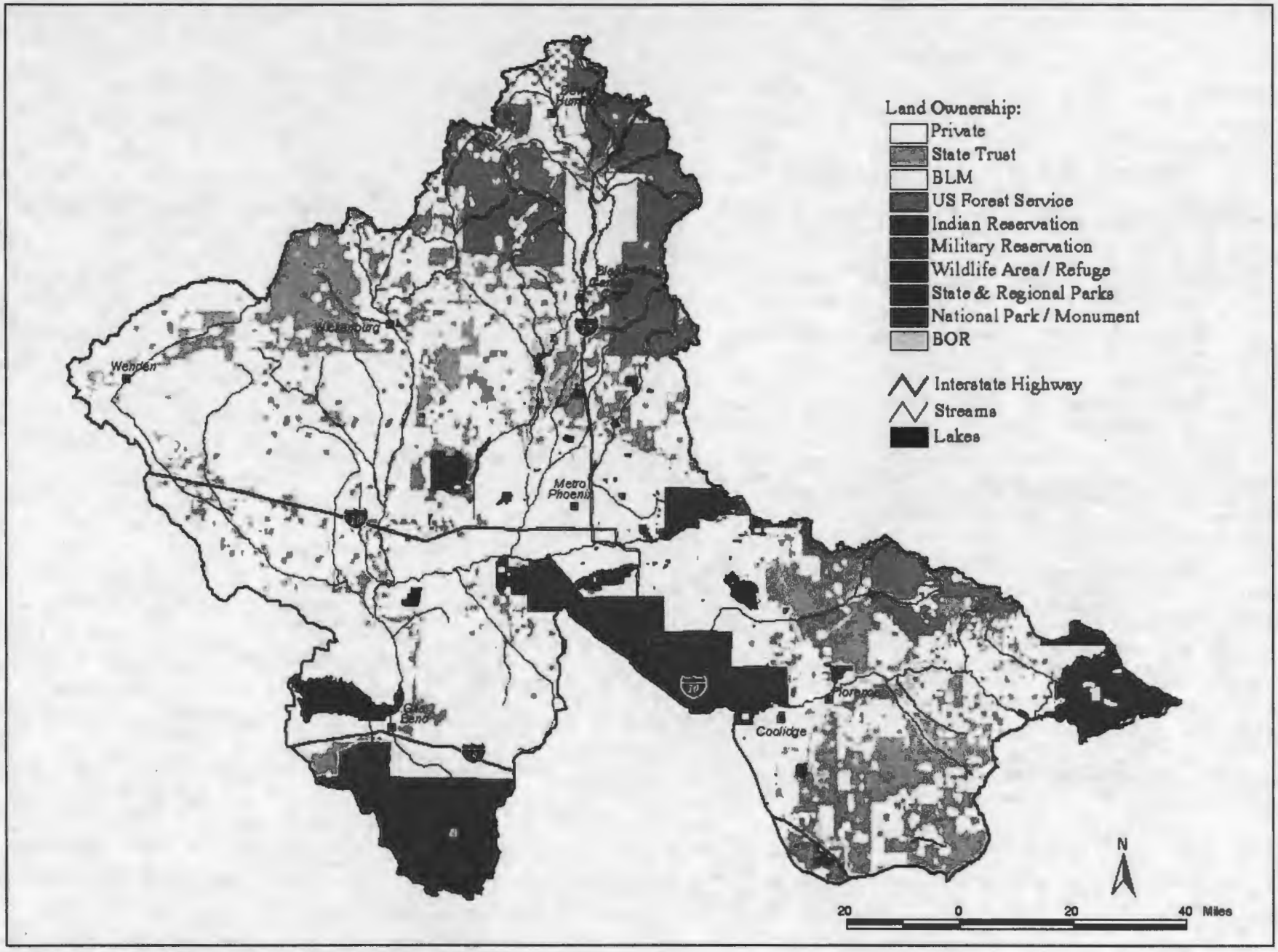

Figure 27. Land Ownership in the Middle Gila Watershed

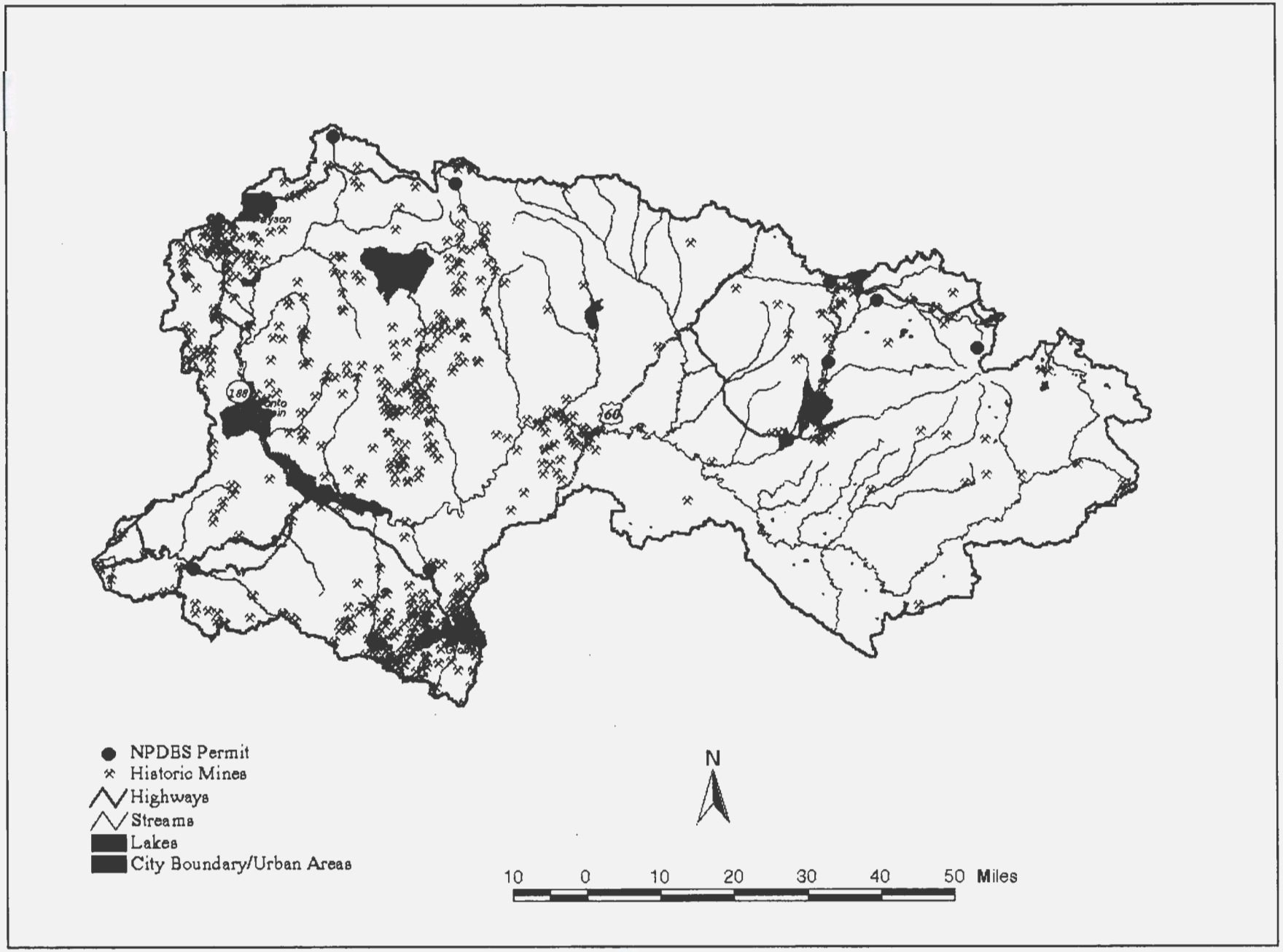

Figure 28. General Land Use and NPDES Permits in the Middle Gila Watershed

Statistical Summary of Surface Water Assessments

Assessments – For the 2002 assessment, 432 miles of streams, washes or canals, and 2,469 acres of lakes were assessed. Fewer assessment were completed than in previous assessments because of two factors: 1) changes in assessment criteria requiring more data to base an assessment, and 2) a lack of current credible data as this is a focus watershed for monitoring in 2002. The new data will be included in the next assessment cycle.

Water quality assessment information for the Middle Gila Watershed is summarized in the following tables and illustrated on **Figure 29**.

Table 15. Assessments in the Middle Gila Watershed – 2002

	STREAMS AND CANALS		LAKES	
	miles	number of segments	acres	number of lakes
ATTAINING	52	2	97	5
INCONCLUSIVE	305	26	2,152	3
IMPAIRED	75	6	220	1
NOT ATTAINING	0	0	0	0
TOTAL ASSESSED	432	34	2,469	9

PERENNIAL SURFACE WATERS ASSESSED		STREAMS AND CANALS		LAKES	
		miles	number of segments	acres	number of lakes
	Assessed	220	21	2,369	8

* Note that streams with significant perennial stretches within the reach assessed were included in the perennial milage although part of the reach may have ephemeral or intermittent flow.

Inconclusive assessments – Surface waters with some monitoring data, but insufficient data to determine if a designated use is attaining or impaired, were added to the new Planning List. By the end of the next watershed monitoring cycle (scheduled in 2007), ADEQ expects to monitor most of these reaches so that all designated uses can be assessed during the following assessment cycle. Other lakes and streams which lack any monitoring data will also be monitored as resources and priorities allow.

ADEQ will be working with US Geological Survey, the Arizona Game and Fish Department, and the Salt River Project, so that their future monitoring will better support Arizona's surface water assessments. For example, all of the canals in the Phoenix metropolitan area were assessed as "inconclusive" because only dissolved metals were analyzed while total metal measurements are also needed to complete assessments.

Major stressors – When a surface water is listed as impaired, the pollutants or suspected pollutants causing the impairment are identified. The stream reaches and lakes assessed as impaired can be divided into three groups based on pollutants and their probable sources as follows:

- Historic mining activities have caused impairment of 70 miles of stream reaches along Mineral Creek, Turkey Creek, Queen Creek, and the Hassayampa River due to metals and related low pH;
- High levels of boron occur in the Gila River below the Phoenix metropolitan area; and
- High pH is occurring in the newly constructed Tempe Town Lake.

Watershed assessment map

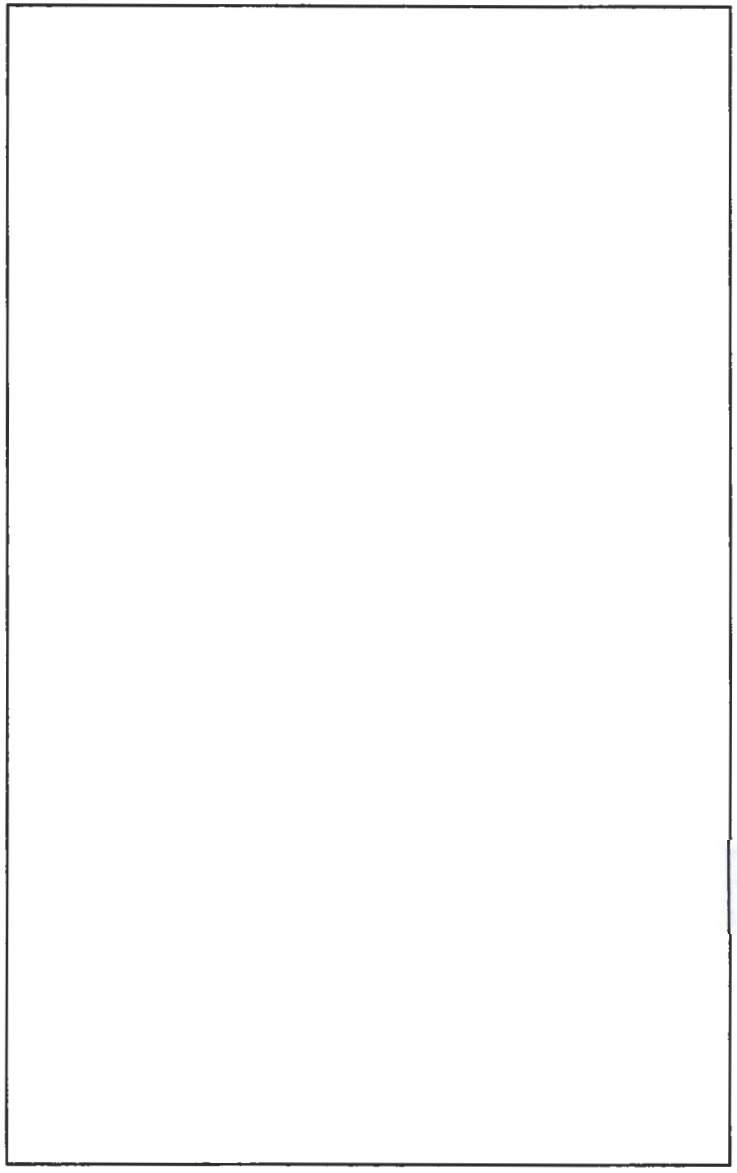

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA - 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
STREAM MONITORING DATA								
Agua Fria River Sycamore Creek-Big Bug AZ15070102-023 A&Ww, FC, FBC, DWS, AgI, AgL	ADEQ Biocriteria Program Above Big Bug Creek MGAFR064.94 100711	1998 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Agua Fria River Little Squaw Creek-Cottonwood AZ15070102-017 A&Ww, FC, FBC, DWS, AgI, AgL	USGS Station #09512800 Near Rock Springs MGAFR043.88 100778	1996 - 1 suite	OK					
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Agua Fria River Lake Pleasant-Beardsley AZ15070102-008 A&We, PBC, AgL	USGS Station #09523600 Below Waddell Dam MGAFR030.73 100781	1996 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Antelope Creek headwaters-Martinez Creek AZ15070103-010 A&Ww, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Above Road Xing near Stanton MGANT011.29 100713	1998 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Arizona Canal Cholla WTP-15070102 begins AZ15060106B-099B AgI, AgL	SRP Routine Monitoring At 75th Avenue & Greenway MGAZC001.48 SVLT 1-20.0	1996 - 10 suites 1997 - 11 suites 1998 - 11 suites, 10 VOCs 1999 - 11 suites, 5 VOCs 2000 - 11 suites, 8 VOCs, 8 pesticides	OK					Missing core parameters: total metals (only dissolved metals reported).
	Reach Summary Row AgI Inconclusive AgL Inconclusive	1996 - 2000 54 sampling events Missing core parameters	OK				Inconclusive	SRP collected 54 samples in 1996 - 2000. Canal assessed as "Inconclusive" and added to Planning List due to missing core parameters.
Arizona Canal Granite Reef Dam-Cholla WTP AZ15060106B-099A DWS, AgI, AgL	SRP Routine Monitoring At Granite Reef SVCA 1-0.0	1996 - 10 suites, 1 VOCs 1997 - 11 suites, 8 VOCs 1998 - 12 suites, 12 VOCs 1999 - 11 suites, 5 VOCs 2000 - 13 suites, 9 VOCs, 9 pesticides	OK					Missing core parameters: total metals including total arsenic and total barium (only dissolved metals reported).

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA - 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	SRP Routine Monitoring At Invergorden (64th Street) MGAZC014.51 SVCA 1-3.9	1996 - 10 suites,1 VOCs 1997 - 11 suites, 8 VOCs 1998 - 11 suites,10 VOCs 1999 - 11 suites, 5 VOCs 2000 - 11 suites, 8 VOCs, 8 pesticides	Boron µg/L	630 (DWS) 1000 (AgI)	560 - 1106 (dissolved)	1 of 54		
	SRP Routine Monitoring At Squaw Peak WTP SVCA 1-9.3	1997 - 13 nutrients, 3 VOCs 1998 - 11 nutrients, 3 VOCs 1999 - 11 nutrients, 2 VOCs 2000 - 11 nutrients, 3 VOCs, 3 pesticides	OK					
	SRP Routine Monitoring At Deer Valley WTP SVCA 1-14.5	1996 - 2 nutrients 1997 - 11 nutrients 1998 - 11 nutrients 1999 - 11 nutrients 2000 - 11 nutrients, 3 VOCs, 3 pesticides	OK					
	SRP Routine Monitoring At Cholla WTP SVCA 1-16.6	1996 - 2 nutrients 1997 - 11 nutrients 1998 - 11 nutrients 1999 - 11 nutrients 2000 - 11 nutrients, 3 VOCs, 3 pesticides	OK					
	Reach Summary Row DWS Inconclusive AgI Inconclusive AgL Inconclusive	**1996 - 2000** **249 sample events** **Missing core parameters**	**Boron** **µg/L**	**630** **(DWS)** **1000** **(AgI)**	**560 - 1106** **(dissolved)**	**1 of 54**	**Inconclusive**	**SRP collected a total of 249 samples at five sites in 1996-2000. Canal assessed as "inconclusive" and added to the Planning List due to missing core parameters.**
Buckeye Canal 15070101-Hassayampa AZ15070101-209 AgI, AgL	USGS NAWQA Site #09514000 Near Avondale MGBKC000.01	1996 - 4 suites 1997 - 20 suites, VOCs, pesticides 1998 - 10 suites, pesticides	p,p' DDE µg/L	0.001 (AgI, AgL)	0.0087	1 of 1		17 other DDE samples were not counted because the Method Detection Limit was higher than the standard. 16 other samples were not included because they were laboratory estimates (less than the MDL). Missing core parameters: total metals (only dissolved metals reported).
	Reach Summary Row AgI Inconclusive AgL Inconclusive	**1996 - 1998** **34 sampling events** **Missing core parameters**	**p,p' DDE** **µg/L**	**0.001** **(AgI, AgL)**	**0.0087**	**1 of 1**	**Inconclusive**	**The USGS collected 34 samples in 1996-1998. Canal assessed as "inconclusive" and added to the Planning List due to DDE exceedance and missing core parameters.**

TABLE 16. MIDDLE GILA WATERSHED – MONITORING DATA – 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Cave Creek headwaters-Cave Creek Dam AZ15060106B-026A A&Ww, FC, FBC, AgL	AGFD Complaint Investigation 4 sites around Silver-X mine MGCVE024.87	1996 - 1 metals, pH	OK					
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Consolidated Canal 15060106B- WTP intake AZ15050100-074A DWS, AgI, AgL	SRP Routine Monitoring At Pecos MGCNC010.03 SVCA 5-14.0	1996 - 12 suites, 3 VOCs 1997 - 11 suites, 9 VOCs 1998 - 11 suites, 10 VOCs 1999 - 12 suites, 6 VOCs 2000 - 12 suites, 9 VOCs, 9 pesticides	OK					Missing core parameters: total metals including total arsenic and total barium (only dissolved metals reported).
	Reach Summary Row DWS Inconclusive AgI Inconclusive AgL Inconclusive	1996 - 2000 58 sampling events Missing core parameters	OK				Inconclusive	SRP collected 58 samples in 1996 - 2000. Canal assessed as "inconclusive" and added to the Planning List due to missing core parameters.
Crazy Basin Wash headwaters - Poland Wash A&Ww, FBC, FC, AgL	ADEQ TMDL Program French Lily	2001 - 1 metals (no hardness)	OK					
	Reach Summary Row	2000 1 sampling event	OK				Not assessed	Insufficient monitoring events and core parameters to assess.
Devils Canyon headwaters-Mineral Creek AZ15050100-1662 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program South of Highway 60 MGDVC004.36 100534	1997 - 1 suite	OK					
	Reach Summary Row	1997 1 sampling event	OK				Not assessed	Insufficient data to assess.
Dripping Spring Wash headwaters-Gila River AZ15050100-011 A&Ww, FC, FBC, AgL	AGFD Routine Monitoring At Gila River 3 sites combined MGDSW000.21	1997 - 2 suites 1999 - 1 metals	OK					Missing all core parameters except arsenic & copper. The mercury Method Detection Limit was not low enough to assess Fish Consumption.
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1997 - 1999 3 sampling events Missing core parameters	OK				Inconclusive	AGFD collected three samples in 1997-1999. Reach assessed as "inconclusive" and added to the Planning List due to missing core parameters and mercury's method detection limit.
Eastern Canal WTP below Warner Road-terminus AZ15050100-207B AgI, AgL	SRP Routine Monitoring Lateral 14.2 near Pecos MGESC012.13 SVCA 4-14.2	1996 - 9 suites, 1 VOCs 1997 - 9 suites, 7 VOCs 1998 - 10 suites, 9 VOCs 1999 - 9 suites, 4 VOCs 2000 - 9 suites, 8 VOCs, 8 pesticides	OK					Missing core parameters: total metals, only dissolved metals reported.

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row AgI Inconclusive AgL Inconclusive	1996 - 2000 56 56 sampling events Missing core parameters	OK				Inconclusive	SRP collected a total of 56 samples in 1996-2000. Canal assessed as "inconclusive" and added to the Planning List due to missing core parameters.
Eastern Canal University Ave-WTP Warner Rd. AZ15050100-207A DWS, AgI, AgL	SRP Routine Monitoring At Guadalupe (Gilbert WTP) SVCA 4-9.0	1996 - 2 nutrients 1997 - 11 nutrients, 3 VOCs 1998 - 11 nutrients, 3 VOCs 1999 - 12 nutrients, 2 VOCs 2000 -12 nutrients, 3 VOCs, 3 pesticides	OK					Missing core parameters: total metals including total arsenic and total barium (only dissolved metals reported).
	SRP Routine Monitoring At Warner Ave, Tempe MGESC009.15 SVCA 4-11.0	1996 - 12 suites, 3 VOCs 1997 - 11 suites, 9 VOCs 1998 - 11 suites, 11 VOCs 1999 - 11 suites, 6 VOCs 2000 - 11 suites, 8 VOCs, 8 pesticides	OK					
	Reach Summary Row DWS Inconclusive AgI Inconclusive AgL Inconclusive	1996 - 2000 104 samples 60 sampling events Missing core parameters	OK				Inconclusive	SRP collected 48 samples in 1996 - 2000. Canal assessed as "inconclusive" and added to the Planning List due to missing core parameters.
French Gulch headwaters-Hassayampa River AZ15070102-239 A&Ww, FBC, FC, AgI, AgL	Arimetco, Inc. Compliance monitoring Above Zonia Gulch (& mine) (MGFRE-AZG)	1996 - 20 suites 1997 - 10 suites 1998 - 9 suites 1999 - 9 suites 2000 - 10 suites	Arsenic (total) µg/L	50 (FBC)	<5 - 74	1 of 59		Missing core parameters: dissolved oxygen, bacteria, boron, and dissolved cadmium, chromium, and lead. 133 beryllium samples were not included because the Method Detection Limits was too high to assess Fish Consumption.
			Beryllium (total) µg/L	0.21 (FC)	0.03 - 2.0	1 of 5		
			Copper (dissolved) µg/L	varies (65) (A&Ww)	<10 - 300	31 of 56		
			Manganese (total) µg/L	10,000 (AgI)	380 - 52,000	55 of 59		
				19,600 (FBC)		53 of 59		
			Mercury (total) µg/L	0.6 (FC)	0.2 - 1.7	2 of 59		
			Zinc (dissolved) µg/L	varies (379) (A&Ww)	80 - 1100	20 of 56		

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA – 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Arimetco, Inc. Compliance monitoring Below Zonia Gulch (MGFRE-BZG)	1996 - 20 suites 1997 - 10 suites 1998 - 10 suites 1999 - 9 suites 2000 - 10 suites	Arsenic (total) µg/L	50 (FBC)	<5 - 94	1 of 58		Missing core parameters: dissolved oxygen, bacteria, boron, and dissolved cadmium, chromium, and lead.
			Copper (dissolved) µg/L	varies (65) (A&Ww)	<10 - 1200	49 of 55		
			Copper (total) µg/L	500 (AgL)	14 - 1400	29 of 58		
			Manganese (total) µg/L	10,000 (AgI)	190 - 47,700	54 of 58		
				19,600 (FBC)		33 of 48		
			Mercury (total) µg/L	0.6 (FC)	<0.2 - 1.1	1 of 58		
			Zinc (dissolved) µg/L	varies (379) (A&Ww)	40 - 2260	46 of 55		
	Arimetco, Inc. Compliance monitoring Above Placerita Gulch (MGFRE-APG)	1996 - 2 suites 1997 - 2 suites 1998 - 2 suites 1999 - 2 suites 2000 - 3 suites	Manganese (total) µg/L	10,000 (AgI)	<10 - 18,600	1 of 11		Missing core parameters: dissolved oxygen, bacteria, boron, and dissolved cadmium, chromium, and lead.
			Mercury (total) µg/L	0.6 (FC)	<0.2 - 1.7	1 of 11		
	Arimetco, Inc. Compliance monitoring Below Placerita Gulch (MGFRE-BPG)	1996 - 3 suites 1997 - 2 suites 1998 - 2 suites 1999 - 3 suites 2000 - 3 suites	Mercury (total) µg/L	0.6 (FC)	<0.2 - 1.9	1 of 12		Missing core parameters: dissolved oxygen, bacteria, boron, and dissolved cadmium, chromium, and lead.
	Reach Summary Row A&Ww impaired FC Inconclusive FBC Impaired AgI Impaired AgL Impaired	1996 - 2000 140 samples 60 sampling events Missing core parameters	Arsenic (total) µg/L	50 (FBC)	<5 - 94	2 of 140	Attaining	Arimetco collected a total of 140 samples at 4 sampling sites in 1996-2000. Reach is assessed as impaired due to copper, manganese and zinc. Add to Planning List due to exceedances of beryllium and missing core parameters.
			Beryllium (total) µg/L	0.21 (FC)	0.03 - 2.0	1 of 7	Inconclusive	
			Copper (dissolved) µg/L	varies (65) (A&Ww)	<10 - 1200	80 of 135	Impaired	
			Copper (total) µg/L	500 (AgL)	14 - 1400	29 of 140	Impaired	
			Manganese (total) µg/L	10,000 (AgI)	190 - 52,000	110 of 140	Impaired	
				19,600 (FBC)		96 of 140	Impaired	
			Mercury (total) µg/L	0.6 (FC)	<0.2 - 1.9	5 of 140	Attaining	
			Zinc (dissolved) µg/L	varies (379) (A&Ww)	40 - 2260	66 of 135	Impaired	

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA - 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Gila River Dripping Spring-San Pedro River AZ15050100-009 A&Ww, FC, FBC, AgL	AGFD Special Investigation Below Dripping Spring MGGLR146.49	1997 - 2 suites	OK					Missing core parameters: turbidity, bacteria, boron, and metals. Also, the Mercury Method Detection Limit was too high to assess Fish Consumption.
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1997 2 sampling events Missing core parameters	OK				Inconclusive	AGFD collected two samples in 1997. Reach assessed as "inconclusive" and added to Planning List due to missing core parameters, lack of sampling events, and the laboratory reporting limit for mercury.
Gila River, San Pedro-Mineral Creek AZ15050100-008 A&Ww, FC, FBC, AgI, AgL	USGS NAWQA Site #09474000 At Kelvin MGGLR136.90	1996 - 8 suites 1997 - 12 suites 1998 - 6 suites	OK					Missing core parameters: turbidity, bacteria, boron, and insufficient metals.
	AGFD Special Investigation Above Mineral Creek MGGLR136.98	1997 - 2 suites	OK					Missing core parameters: turbidity, bacteria, boron, and insufficient metals. The Mercury Method Detection Limit was too high to assess Fish Consumption use.
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	1996 - 1998 28 sampling events Missing core parameters	OK				Inconclusive	USGS collected 26 samples in 1996-1998. AGFD collected 2 samples in 1997. Reach assessed as "inconclusive" and added to the Planning List due to missing core parameters and laboratory reporting limit for mercury
Gila River Ashurst-Hayden-Florence WWTP AZ15050100-003B A&We, PBC, AgL	AGFD Special Investigation At Ashurst-Hayden Dam MGGLR127.23	1997 - 2 suites	Copper (total) µg/L	500 (AgL)	<50 - 710	1 of 2		Missing core parameters: turbidity, bacteria, boron, insufficient metals.
	Reach Summary Row A&We Inconclusive PBC Inconclusive AgL Inconclusive	1997 2 sampling events Missing core parameters	Copper (total) µg/L	500 (AgL)	<50 - 710	1 of 2	Inconclusive	AGFD collected two samples in 1997. Reach assessed as "inconclusive" and added to the Planning List due to copper exceedance, insufficient sampling events, and missing core parameters.
Gila River Agua Fria River-Waterman Wash AZ15070101-014 A&Wedw, FC, PBC, AgI, AgL	USGS NAWQA Site #09514100 At Estrella Parkway MGGLR093.63	1998 - 1 suite, pesticide	OK					Missing core parameters: turbidity, metals, bacteria, boron
	USGS NAWQA Site #09513990 Above Head of Buckeye Canal MGGLR094.27	1996 - 6 suites, pesticides	OK					Missing core parameters: turbidity, metals, bacteria, boron

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA - 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row A&Wedw Inconclusive FC Inconclusive PBC Inconclusive Agl Inconclusive AgL Inconclusive	1996 - 1998 7 sampling events Missing core parameters	OK				Inconclusive	USGS collected a total of 7 samples at two sites in 1996-1998. Reach is assessed as "inconclusive"and added to Planning List due to missing core parameters.
Gila River Gillespie Dam-Centennial Wash AZ15070101-008 A&Wedw, FC, PBC, Agl, AgL	USGS Station #09518000 Above Gillespie Dam MGGLR075.86 100734	1996 - 6 suites 1997 - 6 suites 1998 - 5 suites 1999 - 4 suites 2000 - 4 suites	Boron (total) µg/L	1000 (Agl)	375 - 2235	16 of 21		
			Beryllium (total) µg/L	0.21 (FC)	<0.1 - 0.6	4 of 11		12 other beryllium samples were not counted because the Method Detection Limit was too high to assess Fish Consumption.
			Fecal coliform CFU	800 (A&Wedw)	30 - 2400	3 of 22		
			Mercury (total) µg/L	0.6 (FC)	<0.1 - 1.1	1 of 25		
			Selenium (total) µg/L	20 (Agl)	<0.1 - 33.8	3 of 22		
			Turbidity NTU	50 (A&Wedw)	0.34 - 95.0	3 of 25		
	Reach Summary Row A&Wedw Attaining FC Inconclusive PBC Attaining Agl Impaired AgL Attaining	1996 - 2000 25 sampling events	Boron (total) µg/L	1000 (Agl)	375 - 2235	16 of 21	Impaired	USGS collected 25 samples in 1996-2000. Reach is assessed as impaired due to boron. Also, added reach to Planning List due to beryllium exceedances.
			Beryllium (total) µg/L	0.21 (FC)	<0.1 - 0.6	4 of 11	Inconclusive	
			Fecal coliform CFU	800 (A&Wedw)	30 - 2400	3 of 22 (over 4 years)	Attaining	
			Mercury (total) µg/L	0.6 (FC)	<0.1 - 1.1	1 of 25	Attaining	
			Selenium (total) µg/L	20 (Agl)	<0.1 - 33.8	3 of 22	Attaining	
			Turbidity NTU	50 (A&Wedw)	0.34 - 95.0	3 of 25	Attaining	
Grand Canal 15070101-New River AZ15070102-250 Agl, AgL	SRP/USGS Routine Monitoring At 99th Ave, Phoenix SVLT 2-23-0 MGGRC000.70	1996 - 10 suites 1997 - 12 suites 1998 - 11 suites 1999 - 11 suites 2000 - 11 suites	OK					Missing core parameters: no total metals, only dissolved metals reported.

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row AgI Inconclusive AgL Inconclusive	1996 - 2000 55 samples Missing core parameters	OK				Inconclusive	SRP collected 55 samples in 1996-2000. Canal assessed as "inconclusive" due to missing core parameters (total metals).
Hassayampa River headwaters-Copper Creek AZ15070103-007A A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Program At Babble MGHSR110.65 100942	2000 - 1 field, metals	Copper (dissolved) µg/L	varied hardness (A&Ww)	43	1 of 1		
			Zinc (dissolved) ug/l	varied hardness (A&Ww)	380	1 of 1		
	ADEQ TMDL Program Below Senator Mine MGHSR109.68 101036	2000 - 1 metal, nutrient	Zinc (dissolved) µg/L	varied hardness (A&Ww)	770	1 of 1		
	ADEQ TMDL Program At Whispering Pines MGHSR108.17 100941	2000 - 1 field, metal	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.05	1 of 1		Naturally occurring low dissolved oxygen (DO) due to ground water upwelling. Exceedance not included in final assessment.
			Zinc (dissolved) µg/L	varied hardness (A&Ww)	510	1 of 1		
	Reach Summary Row A&Ww Impaired FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	1996 - 2000 3 samples 2 sampling events Missing core parameters	Copper (dissolved) µg/L	varied hardness (A&Ww)	13 - 43	1 of 3	Inconclusive	ADEQ collected a total of 3 samples from 3 sites in 2000. Reach is assessed as "Impaired" due to zinc. Add to Planning List due to copper exceedance, missing core parameters, and lack of sampling events.
			Zinc (dissolved) µg/L	varied hardness (A&Ww)	380 - 770	3 of 3	Impaired	
Hassayampa River Copper Creek-Blind Indian AZ15070103-007B A&Ww, FC, FBC, AgI, AgL	ADEQTMDL Program At gaging station MGHSR089.37 100940	2000 - 1 field, 1 metal	OK					
	ADEQ Fixed Station Network Near Wagoner, below Milk Creek MGHSR063.02 100464	1996 - 5 suites 1999 - 3 suites 2000 - 4 suites	Arsenic (total) µg/L	50 (FBC)	<10 - 67	1 of 12		
			Beryllium (total) µg/L	0.21 (FC)	16	1 of 1		11 other beryllium samples were not included because the Method Detection Limit was not low enough to assess Fish Consumption.
			Beryllium (total) µg/L	4 (FBC)	<0.5 - 16	1 of 12		
			Copper (total) µg/L	500 (AgL)	<10 - 1100	1 of 12		

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	2.64 - 8.16	6 of 12		Naturally occurring low dissolved oxygen due to ground water upwelling. These exceedances were not included in the final assessment.
			Fecal coliform CFU/100 ml	4000 (A&Ww, Agl, AgL)	0 - 6400	1 of 8		
			Lead (total) µg/L	100 (AgL)	<5 - 150	1 of 12		
			Turbidity NTU	50 (A&Ww)	0.8 - 1000	1 of 11		
	Reach Summary Row A&Ww Inconclusive FC Attaining FBC Attaining Agl Inconclusive AgL Inconclusive	1996 - 2000 13 samples	Arsenic (total) µg/L	50 (FBC)	<10 - 67	1 of 12	Attaining	ADEQ collected a total of 13 samples from 2 sites in 1996, 1999-2000. Reach assessed as "attaining some uses." Add to Planning List due to fecal coliform and beryllium exceedances.
			Beryllium (total) µg/L	0.21 (FC)	16	1 of 1	Inconclusive	
			Beryllium (total) µg/L	4 (FBC)	<0.5 - 16	1 of 12	Attaining	
			Copper (total) µg/L	500 (AgL)	<10 - 1100	1 of 13	Attaining	
			Fecal coliform CFU/100 ml	4000 (A&Ww, Agl, AgL)	0 - 6400	1 of 8	Inconclusive	
			Lead (total) µg/L	100 (AgL)	<5 - 150	1 of 12	Attaining	
			Turbidity NTU	50 (A&Ww)	0.8 - 1000	1 of 12	Attaining	
Hassayampa River Cottonwood Creek-Martinez AZ15070103-004 A&Ww, FC, FBC, Agl, AgL	ADEQ Fixed Station Network At Box Canyon Dam MGHSR049.89 100463	1999 - 3 suites 2000 - 4 suites	Arsenic (total) µg/L	50 (FBC)	<10 - 53	1 of 7		
			Beryllium (total) µg/L	0.21 (FC)	3.7 - 13	2 of 2		Seven other beryllium samples were not included because the Method Detection Limit was too high to assess Fish Consumption.
			Beryllium (total) µg/L	4 (FBC)	<0.5 - 13	1 of 7		
			Copper (total) µg/L	500 (AgL)	<10 - 610	1 of 7		
			Escherchia coli cfu/100 ml	580 (FBC)	2 - 11400	1 of 6		
			Lead (total) µg/L	100 (AgL)	<5 - 170	1 of 7		

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Turbidity NTU	50 (A&Ww)	0.8 - >1000	2 of 7		
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgI Attaining AgL Inconclusive	1999 - 2000 7 samples	Arsenic (total) µg/L	50 (FBC)	<10 - 53	1 of 7	Inconclusive	USGS collected 7 samples in 1999-2000. Reach assessed as "attaining some uses." Add to Planning List due to exceedances of arsenic, beryllium, copper, E. coli, lead, and turbidity.
			Beryllium (total) µg/L	0.21 (FC)	3.7 - 13	2 of 2	Inconclusive	
			Beryllium (total) µg/L	4 (FBC)	<0.5 - 13	1 of 7	Inconclusive	
			Copper (total) µg/L	500 (AgL)	<10 - 610	1 of 7	Inconclusive	
			Escherchia coli cfu/100 ml	580 (FBC)	2 - 11400	1 of 6	Inconclusive	
			Lead (total) µg/L	100 (AgL)	<5 - 170	1 of 7	Inconclusive	
			Turbidity NTU	50 (A&Ww)	0.8 - >1000	2 of 7	Inconclusive	
Hassayampa River Buckeye Canal - Gila River AZ15070103-001B A&Ww, FC, FBC, AgL	USGS NAWQA Site #09517000 Below Buckeye Canal near Arlington MGHSR001.56	1996 - 8 suites, pesticides 1997 - 29 suites, pesticides 1998 - 11 suites, pesticides	DDE µg/L	0.001 (AgL) 0.0006 (FC)	0.0061 - 0.012	10 of 10		23 other DDE samples were not included because they were laboratory estimated values below the Method Detection Limit (MDL). Seven additional samples were also not counted because their MDL was higher than the AgL standard. Missing core parameters: no turbidity, bacteria, insufficient metals
			Ammonia mg/L	varies (A&Ww)	0.03 - 11.0	2 of 48		Standard varies dependent on pH and temperature.
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1996 - 1998 48 samples Missing core parameters	p,p' DDE µg/L	0.001 (AgL) 0.0006 (FC)	0.0061 - 0.012	10 of 10	Inconclusive (see comment)	USGS collected 48 samples in 1996-1998. Reach assessed as "inconclusive" and added to the Planning List due to missing core parameters.
			Ammonia mg/L	varies (A&Ww)	0.03 - 11.0	2 of 48	Attaining	
Little Ash Creek headwaters-Ash Creek AZ15070102-039 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program Near Estler Peak MGLAS003.16 100578	1998 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess. Not enough sampling events.

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Lynx Creek headwaters-Agua Fria River AZ15070102-033 A&Ww, FC, FBC, AgL	AGFD Routine Monitoring MGLNX008.50	1998 - 1 metals only 1 field + nutrients + NH3	Cadmium (total) µg/L	41 (FC) 70 (FBC) 50 (AgL)	104	1 of 1		
			Copper (total) µg/L	500 (AgL)	1580	1 of 1		
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1998 2 sampling events Missing core parameters	Cadmium (total) µg/L	41 (FC) 70 (FBC) 50 (AgL)	104	1 of 1	Inconclusive	AGFD collected two samples in 1998. Reach assessed as "inconclusive" and should be added to the Planning List due to cadmium and copper exceedances, lack of monitoring events, and missing core parameters.
			Copper (total) µg/L	500 (AgL)	1580	1 of 1	Inconclusive	
Mineral Creek Devils Canyon-Gila River AZ15050100-012B A&Ww, FC, FBC, AgL	ASARCO Permit Monitoring At Indian Gardens (above mine) (Surf 1) MGMIN007.55	1997 - 1 suite 1998 - 12 suites 1999 - 12 suites 2000 - 12 suites	Beryllium (total) µg/L	0.21 (FC)	<0.2 - 1.0	2 of 37		Missing core parameter: bacteria.
			Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	3.5 - 17.5	11 of 32		Low dissolved oxygen is a natural condition due to ground water upwelling. These exceedances were not included in the final assessment.
			Turbidity NTU	50 (A&Ww)	0.5 - 960	3 of 37		Missing core parameter: bacteria.
	ASARCO Permit Monitoring Mineral Creek Diversion Tunnel Inlet MGMIN005.77	1998 - 10 suites 1999 - 12 suites 2000 - 12 suites	Beryllium (total) µg/L	0.21 (FC)	<0.2 - 47.0	23 of 34		Missing core parameter: bacteria.
			Beryllium (total) µg/L	4 (FBC)	<0.2 - 47.0	7 of 34		
			Cadmium (dissolved) µg/L	varied hardness (A&Ww)	<0.5 - 520	2 of 34		
			Cadmium(total) µg/L	41 (FC) 50 (AgL) 70 (FBC)	<0.5 - 550	6 of 34 5 of 34 5 of 34		
			Chromium VI µg/L	16 (A&Ww)	<10 - 20	1 of 34		
			Copper (dissolved) µg/L	varied hardness (A&Ww)	<20 - 19000	20 of 34		
			Copper (dissolved) µg/L	5200 (FBC)	<20 - 19000	2 of 34		
			Copper (total) µg/L	500 (AgL)	<20 - 20000	9 of 34		

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA - 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	2.23 - 18.27	17 of 31		Low dissolved oxygen is a natural condition due to ground water upwelling. These exceedances were not included in the final assessment.
			Fluoride µg/L	8400 (FBC)	200 -23000	2 of 32		Missing core parameter: bacteria.
			Nickel (total) µg/L	730 (FC)	<50 - 2000	2 of 34		
			pH (low) SU	6.5 - 9.0 (A&W, FBC, AgL)	4.5 - 7.9	10 of 33		
			Turbidity NTU	50 (A&Ww)	0.4 - 560	4 of 34		
			Zinc (dissolved) µg/L	varied hardness (A&Ww))	<40 - 28000	22 of 34		
			Zinc (total) µg/L	22000 (FC) 25000 (AgL)	<40 - 28000	2 of 34 1 of 34		
	ASARCO Permit Monitoring Mineral Creek Diversion Tunnel Outlet (Surf 3) MGMIN004.74	1996 - 10 suites 1997 - 7 suites 1998 - 12 suites 1999 - 12 suites 2000 - 12 suites	Beryllium (total) µg/L	0.21 (FC)	<0.2 - 3.4	16 of 53		Missing core parameter: bacteria.
			Copper (dissolved) µg/L	varied hardness (A&Ww)	<2 - 180	10 of 53		
			Copper (total) µg/L	500 (AgL)	<20 - 2000	4 of 53		
			Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.42 - 17.39	9 of 32		Low dissolved oxygen is a natural condition due to ground water upwelling. These exceedances were not included in the final assessment.
			Turbidity NTU	50 (A&Ww)	0.3 - 535	3 of 53		Missing core parameter: bacteria.
			Sulfide µg/L	100 (A&Ww)	<100 - 400	1 of 17		
			Zinc (dissolved) µg/L	varied hardness (A&Ww)	<40 - 430	2 of 53		

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ASARCO Permit Monitoring RCC Channel Tunnel Outlet (Surf 8) MGMIN002.21	1998 - 8 suites 1999 - 4 suites 2000 - 1 suites	Beryllium (total) µg/L	0.21 (FC)	<0.2 - 3.4	5 of 13		Missing core parameter: bacteria.
			Copper (dissolved) µg/L	varied hardness (A&Ww)	27 - 1400	11 of 13		
			Copper (total) µg/L	500 (AgL)	33 - 1600	5 of 13		
			Turbidity NTU	50 (A&Ww)	1.25 - 508	2 of 13		
			Zinc (dissolved) µg/L	varies (A&Ww)	<40 - 430	1 of 13		
	ASARCO Permit Monitoring Below highway bridge 177 (Surf 10) MGMIN001.35	1996 - 8 suites 1997 - 8 suites 1998 - 8 suites 1999 - 4 suites 2000 - 6 suites	Beryllium (total) µg/L	0.21 (FC)	<0.2 - 1.0	21 of 31		Missing core parameter: bacteria.
			Cadmium (total) µg/L	41 (FC) 50 (AgL) 70 (FBC)	<0.5 - 82	2 of 33 2 of 33 1of 33		
			Copper (dissolved) µg/L	varied hardness (A&Ww)	<20 - 48000	24 of 32		
			Copper (dissolved) µg/L	5200 (FBC)	<20 - 48000	1 of 32		
			Copper (total) µg/L	500 (AgL)	<20 - 51000	14 of 33		
			Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.49 - 9.6	1 of 17		Low dissolved oxygen is a natural condition due to ground water upwelling. These exceedances were not included in the final assessment.
			pH (low) SU	6.5 - 9.0 (A&ww, FBC, AgL)	4.41 - 8.83	1 of 19		Missing core parameter: bacteria.
			Turbidity NTU	50 (A&Ww)	0.16 - 515	5 of 32		
			Zinc (dissolved) µg/L	varied hardness (A&Ww)	<40 - 3500	11 of 32		
	AGFD Special Investigation S.R. 177 Bridge	2000 - 1 suites	OK					Missing core parameters.

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row A&Ww Impaired FC Impaired FBC Inconclusive AgL Impaired	1996 - 2000 171 samples 54 sampling events Missing core parameters	Beryllium (total) µg/L	0.21 (FC)	<0.2 - 47.0	87 of 169	Impaired	ASARCO collected a total of 170 samples from five sites in 1996-2000. AGFD collected 1 sample in 2000. Mineral Creek is assessed as "impaired" due to beryllium, copper, and zinc. At the tunnel inlet site, Mineral Creek is also impaired by low pH.
			Beryllium (total) µg/L	4 (FBC)	<0.2 - 47.0	7 of 169	Attaining	
			Cadmium (dissolved) µg/L	varied hardness (A&Ww)	<0.5 - 520	2 of 169	Attaining	
			Cadmium (total) µg/L	41 (FC) 50 (AgL)	<0.5 - 550	8 of 169	Attaining	
			Cadmium (total) µg/L	70 (FBC)	<0.5 - 550	6 of 169	Attaining	
			Chromium VI µg/L	16 (A&Ww)	<10 - 20	1 of 137	Attaining	
			Copper (dissolved) µg/L	varied hardness (A&Ww)	<20 - 48000	65 of 170	Impaired	
			Copper (dissolved) µg/L	5200 (FBC)	<20 - 48000	1 of 170	Attaining	
			Copper (total) µg/L	500 (AgL)	<20 - 51000	32 of 170	Impaired	
			Fluoride µg/L	8400 (FBC)	200 - 23000	2 of 158	Attaining	
			Nickel (total) µg/L	730 (FC)	<50 - 2000	2 of 160	Attaining	
			pH (low) SU	6.5 - 9.0 (A&ww, FBC, AgL)	4.41 - 8.83	11 of 154 10 of 33 at tunnel inlet	Impaired (at tunnel inlet)	
			Turbidity NTU	50 (A&Ww)	0.16 - 980	17 of 169	Attaining	
			Zinc (dissolved) µg/L	varied hardness (A&Ww)	<40 - 28000	36 of 170	Impaired	
			Zinc (total) µg/L	22000 (FC)	<40 - 28000	2 of 170	Attaining	
			Zinc (total) µg/L	25000 (AgL)	<40 - 28000	1 of 170	Attaining	

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
New River headwaters-Interstate 17 AZ15070102-006A A&Ww, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Above Burnt Hole Canyon MGNWR040.70 100604	1998 - 1 suites	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess. Not enough sampling events.
Queen Creek headwaters-Superior Mine WWTP AZ15050100-014A A&Ww, FC, PBC, DWS, AgL	BHP NPDES Permit monitoring Above mine discharge AMP1	1997 - 2 field, metals 1998 - 3 field, metals	Copper (dissolved) µg/L	varied hardness (A&Ww)	17 - 31	2 of 5		Missing core parameters: dissolved oxygen, turbidity, bacteria, nitrate/nitrite, fluoride, barium, and boron
	Reach Summary Row A&Ww Impaired FC Attaining PBC Inconclusive DWS Inconclusive AgL Attaining	1997- 1998 5 sampling events Missing core parameters	Copper (dissolved) µg/L	varied hardness (A&Ww)	17 - 31	2 of 5 (2 within 2 years)	Impaired	BHP collected 5 samples in 1997-1998. Reach assessed as "impaired" due to dissolved copper.
Queen Creek Superior Mining WWTP-Potts Cyn AZ15050100-014B A&Wedw, PBC	BHP NPDES Permit monitoring Below mine discharge AMP2	1997 - 2 field, metals 1998 - 3 field, metals	OK					Missing core parameters: dissolved oxygen, bacteria, and turbidity.
	Reach Summary Row A&Wedw Inconclusive PBC Inconclusive	1997 - 1998 5 sampling events Missing core parameters	OK				Inconclusive	BHP collected 5 samples in 1997-1998. Reach assessed as "inconclusive" and added to the Planning List due to missing core parameters.
Salt River 23rd Ave WWTP-Gila River AZ15060106B-001D A&Wedw, FC, PBC, AgI, AgL	USGS NAWQA Site #09512407 91st Avenue WWTP Outfall MGSLR010.78	1996 - 10 suites, 1997 - 12 suites, 5 VOCs 1998 - 2 suites	OK					Missing core parameters: turbidity, bacteria, boron, mercury, insufficient metals except manganese.
	Reach Summary Row A&Wedw Inconclusive FC Inconclusive PBC Inconclusive AgI Inconclusive AgL Inconclusive	1996 - 1998 24 sampling events Missing core parameters	OK				Inconclusive	USGS collected 24 samples in 1996-1998. Reach assessed as "inconclusive" and added to the Planning List due to missing core parameters.

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA - 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
South Canal Granite Reef Dam-Consolidated Canal AZ15060103B-180 DWS, AgI, AgL	SRP Routine Monitoring At Granite Reef MGSOC000.05 SVCA 3-0.0	1996 - 12 suites, 3 VOCs 1997 - 11 suites, 9 VOCs 1998 - 12 suites, 12 VOCs 1999 - 11 suites, 5 VOCs 2000 - 13 suites, 9 VOCs, 9 pesticides	OK					Missing core parameters: total metals
	SRP Routine Monitoring At Val Vista Plant SVCA 3-1.4	1996 - 2 nutrients 1997 - 13 nutrients, 2 inorganics, 3 VOCs 1998 - 11 nutrients, 3 VOCs 1999 - 11 nutrients, 1 VOCs 2000 - 12 nutrients, 3 VOCs, 3 pesticides	OK					
	SRP Routine Monitoring At Division Gates Near Brown MGSOC006.83 SVCA 3-3.3	1996 - 12 suites, 3 VOCs 1997 - 11 suites, 9 VOCs 1998 - 11 suites, 11 VOCs 1999 - 10 suites, 4 VOCs 2000 - 12 suites, 9 VOCs, 9 pesticides	OK					
	Reach Summary Row DWS Inconclusive AgI Inconclusive AgL Inconclusive	**1997 - 2000** **164 samples** **61 sampling events** **Missing core parameters**	OK				Inconclusive	**SRP collected 164 samples in 1996-2000. Canal assessed as "inconclusive" due to missing core parameters.**
Sycamore Creek headwaters-Agua Fria River AZ15070102-024 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Near Dugas, above Ranger MGSYD004.90 100704	1998 - 1 suite	OK					
	Reach Summary Row	**1998** **1 sampling event**	OK				Not assessed	**Insufficient data to assess. Not enough sampling events.**
Tempe Canal 15050100-terminus AZ15050100-115 DWS, AgI, AgL	SRP Routine Monitoring At South Treatment Plant, Guadelupe MGTPC004.16 SVCA 6-9.1	1996 - 11 suites, 3 VOCs 1997 - 10 suites, 9 VOCs 1998 - 11 suites, 10 VOCs 1999 - 8 suites, 2 VOCS 2000 - 10 suites, 9 VOCs, 9 pesticides	OK					Missing core parameters: total metals
	Reach Summary Row DWS Inconclusive AgI Inconclusive AgL Inconclusive	**1996 - 2000** **50 samples** **Missing core parameters**	OK				Inconclusive	**SRP collected 50 samples in 1996 - 2000. Canal assessed as "inconclusive" due to missing core parameters.**
Turkey Creek headwaters-Poland Wash AZ15070101-036 A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Program At tailings runoff (in stream) MG	2001 - 2 metals (3 samples each event) **(both are after precipitation)**	Arsenic (total) µg/L	50 (FBC) 200 (AgL) 1450 (FC) 2000 (AgI)	444 - 24700*	2 of 2 2 of 20 1 of 2 1 of 2		* (average of samples each date)

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA - 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Cadmium (dissolved) µg/L	varies (A&Ww)	240 - 931*	2 of 2		* (worst case of samples each date)
			Cadmium (total) µg/L	41 (FC) 50 (AgI/AgL) 70 (FBC)	97 - 485*	2 of 2 2 of 2 2 of 2		* (average of samples each date)
			Copper (dissolved) µg/L	varies (A&Ww)	3888 - 13,600*	2 of 2		* (worst case of samples each date)
			Copper (total) µg/L	500 (AgL) 5000 (AgI)	1618 - 8488*	2 of 2 1 of 2		* (average of samples each date)
			Lead (total) µg/L	100 (AgL)	34 - 625*	1 of 2		* (average of samples each date)
			Zinc (dissolved) µg/L	varies (A&Ww)	29,000 - 158,000*	2 of 2		* (worst case of samples each date)
			Zinc (total) µg/L	10,000 (AgI) 22,000 (FC) 25,000 (AgL) 42,000 (FBC)	12,667 - 99513*	2 of 2 1 of 2 1 of 2 1 of 2		* (average of samples each date)
	ADEQ TMDL Program At bridge just above tailings MG	2001 - 4 metals **(two times during or after precipitation)**	OK					
	ADEQ TMDL Program Below bridge MG	2001 - 3 metals **(1 during precipitation)**	Arsenic (total) µg/L	50 (FBC) 200 (AgL) 1450 (FC) 2000 (AgI)	<5 - 220	1 of 3 1 of 3 0 of 3 0 of 3		* Exceeded during the 1 rain event
			Copper (dissolved) µg/L	varies (A&Ww)	<15 - 41	1 of 3		* Exceeded during the 1 rain event
			Zinc (dissolved) µg/L	varies (A&Ww	<20 - 430	1 of 3		* Exceeded during the 1 rain event
	ADEQ TMDL Program At Forest Road 261	2000 - 1 metals (no hardness) (no precipitation)	OK					
	ADEQ TMDL Program At Forest Road 706	2000 - 1 metals (no hardness) (no precipitation)	OK					
	ADEQ TMDL Program At Goodwin	2000 - 1 metals (no hardness) 2001 - 3 metals (no precipitation)	OK					

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA – 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ TMDL Program At corral	2000 - 1 metal s (no hardness) (no precipitation)	OK					
	ADEQ TMDL Program At Forest Road 93	2000 - 1 metals (no hardness) 2001 - 1 metals (no precipitation)	OK					
	ADEQ TMDL Program Old biocriteria site	2001 1 metals (no precipitation)	OK					
	Reach Summary Row (Critical condition - precipitation) A&Ww Impaired FBC Inconclusive FC Inconclusive Agl Inconclusive AgL Inconclusive	9 samples 5 sampling events Missing Core Parameters	Arsenic (total) µg/L	50 (FBC)	<5 - 24700	3 of 5	Inconclusive	ADEQ collected 9 samples in 2000-2001. Using data collected during runoff events, the reach is assessed as "impaired" due to cadmium, copper and zinc during precipitation events. Add reach to Planning List due to arsenic and lead exceedances. Newer TMDL monitoring data was used because exceedances shows that the reach is impaired and should remain on the 303(d) List.
				200 (AgL)		3 of 5	Inconclusive	
				1450 (FC)		1 of 5	Inconclusive	
				2000 (Agl)		1 of 5	Inconclusive	
			Cadmium (dissolved) µg/L	varies (A&Ww)	240 - 931	2 of 5 (within 3 years)	Impaired	
			Cadmium (total) µg/L	41 (FC)	97 - 485	2 of 5	Inconclusive	
				50 (Agl/AgL)		2 of 5	Inconclusive	
				70 (FBC)		2 of 5	Inconclusive	
			Copper (dissolved) µg/L	varies (A&Ww)	3888 - 13,800	3 of 5 (within 3 years)	Impaired	
			Copper (total) µg/L	500 (AgL)	1618 - 8488	2 of 5	Inconclusive	
				5000 (Agl)		1 of 5	Inconclusive	
			Lead (total) µg/L	100 (AgL)	34 - 625	1 of 5	Inconclusive	
			Zinc (dissolved) µg/L	varies (A&Ww)	29,000 - 158,000	3of 5 (within 3 years)	Impaired	
			Zinc (total) µg/L	10,000 (Agl)	12,667 - 99513	2 of 2	Inconclusive	
				22,000 (FC)		1 of 2	Inconclusive	
				25,000 (AgL)		1 of 2	Inconclusive	
				42,000 (FBC)		1 of 2	Inconclusive	

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA - 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row (Not during critical conditions - precipitation) A&Ww Inconclusive FBC Inconclusive FC Inconclusive Agl Inconclusive AgL Inconclusive	12 samples 12 sampling events Missing core Parameters	OK				Inconclusive	ADEQ collected 12 samples during 2000-2001 at 7 sites. These samples were collected in the absence of a rain event. Reach assessed as "inconclusive" due to lack of core parameters and added to the Planning List.
Unnamed tributary to Turkey Creek AZ15070101- A&Ww, FBC, FC, Agl, AgL	ADEQ TMDL Program At mouth (near mine tailings)	2001 - 1 metals (during precipitation)	OK					
	Reach Summary Row (during precipitation)	1 sampling event 2001	OK				Not assessed	Insufficient monitoring events and core parameters to assess.
Western Canal Tempe Canal-15050100 AZ15060106B-262 Agl, AgL	SRP Routine Monitoring At Lateral 12.8 Near 19th Ave, Phoenix MGWSC012.39 SVCA 7-12.8	1996 - 12 suites, 3 VOCs 1997 - 12 suites, 9 VOCs 1998 - 11 suites, 10 VOCs 1999 - 11 suites, 5 VOCs 2000 - 11 suites, 9 VOCs, 9 pesticides	OK					Missing core parameters: total metals
	Reach Summary Row Agl Inconclusive AgL Inconclusive	1996 - 2000 57 samples Missing core parameters	OK				Inconclusive	SRP collected 57 samples in 1996 - 2000. Canal assessed as "inconclusive" and added to the Planning List due to missing core parameters (total metals).
Western Canal 15050100-terminus AZ15050100-990 DWS, Agl, AgL	SRP Routine Monitoring At Kyrene Intake MGWSC006.00 SVCA 7-22E	1996 - 3 nutrients, inorganics 1997 - 8 metals 1998 - 11 metals 1999 - 4 metals 2000 - 9 suites, 9 VOCs, 9 pesticides	Boron µg/L	630 (DWS) 1000 (Agl)	41 - 1140	1 of 12		Missing core parameters: no total metals
	Reach Summary Row DWS Inconclusive Agl Inconclusive AgL Inconclusive	1996 - 2000 35 samples Missing core parameters	Boron µg/L	630 (DWS) 1000 (Agl)	41 - 1140	1 of 12	Inconclusive	SRP collected 35 samples in 1996 - 2000. Canal assessed as "inconclusive" and added to the Planning List due to missing core parameters (total metals).
LAKES MONITORING DATA								
Alvord Park Lake AZL15060106B-0050 A&Ww, FC, PBC	AGFD Urban Lakes Study MGALV-ABC 101053	1998 - 3 suites 1999 - 1 field	Beryllium µg/L	0.21 (FC)	2.5	1 of 1		Three beryllium samples were not counted because the Method Detection Limit was too high to assess Fish Consumption. Missing core parameters: bacteria.
	AGFD Routine Monitoring up to 6 sites MGALV	1999 - 1 field, ammonia, nutrient samples 2000 - 2 field, ammonia, nutrient samples	OK					Missing core parameters: turbidity and bacteria.

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA - 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Urban Lakes Study MGALV-A 101040	1998 - 10 field 1999 - 2 field	pH (high) SU	6.5 - 9.0 (A&Ww, PBC)	7.78 - 9.24	1 of 12		Alvord Lake exhibited high dissolved oxygen and high pH readings caused by an algal bloom during the sampling event in June 29, 1998.
	ADEQ Urban Lakes Study MGALV-B 101041	1998 - 10 field 1999 - 2 field	pH (high) SU	6.5 - 9.0 (A&Ww, PBC)	8.39 - 9.26	1 of 12		
	ADEQ Urban Lakes Study MGALV-C 101042	1998 - 10 field 1999 - 2 field	pH (high) SU	6.5-9.0 (A&Ww, PBC)	7.9 - 9.23	1 of 12		
	Reach Summary Row A&Ww Inconclusive FC Attaining PBC Inconclusive	1996 - 2000 43 samples 19 sampling events Missing bacteria samples	Beryllium µg/L	0.21 (FC)	2.5	1 of 1	Inconclusive	ADEQ and AGFD collected a total of 19 sample events at ten sites in 1998-2000. Sample results collected during the same sampling event were combined in this summary row. Lake assessed as "attaining some uses". Add to Planning List due to beryllium exceedance and missing core parameters.
			pH (high) SU	6.5 - 9.0 (A&Ww, PBC)	7.78 - 9.26	1 of 19	Attaining	
Chaparral Lake AZL15060106B-0300 A&Ww, FC, PBC, AgI	AGFD Routine Monitoring MGCHA	1997 - 1 field	OK					Missing core parameters: bacteria. (No mining activities in the watershed so metals are not required.)
	ADEQ & AGFD Urban Lakes MGCHA-A 101045	1998 - 10 field 1999 - 2 field	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.6 - 13.98	2 of 12		
			pH (high) SU	6.5 - 9.0 (A&Ww, PBC, AgI)	7.86 - 9.36	3 of 12		
	ADEQ & AGFD Urban Lakes MGCHA-B 101046	1998 - 10 field 1999 - 2 field	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.18 - 13.82	2 of 12		
			pH (high) SU	6.5 - 9.0 (A&Ww, PBC, AgI)	8.01 - 9.38	2 of 12		
	ADEQ & AGFD Urban Lakes MGCHA-AB 101056	1998 - 3 metals, ammonia, inorganics 1999 - 1 field	OK					
	Reach Summary Row A&Ww Inconclusive FC Attaining PBC Inconclusive AgI Inconclusive	1997 - 1999 29 samples 16 sampling events Missing bacteria samples	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.6 - 13.98	2 of 12	Attaining	ADEQ and AGFD collected a total of 16 sample events at four sites in 1997-1999. Lake assessed as "attaining some uses"and was added to the Planning List due to pH exceedance and missing core parameters.
			pH (high) SU	6.5 - 9.0 (A&Ww, PBC, AgI)	7.86 - 9.38	3 of 12	Inconclusive	

TABLE 16. MIDDLE GILA WATERSHED – MONITORING DATA – 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Cortez Park Lake AZL15060106B-0410 A&Ww, FC, PBC, AgI	ADEQ & AGFD Urban Lakes MGCOR-A 101043	1998 - 10 field 1999 - 2 field	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.02 - 12.78	1 of 12		Data collected at these sites during the same sampling events were combined for the assessment as they are not spatially independent. Missing core parameters: bacteria.
			pH (high) SU	6.5 - 9.0 (A&Ww, PBC, AgI)	8.09 - 9.96	5 of 12		
	ADEQ & AGFD Urban Lakes MGCOR-B 101044	1998 - 10 field 1999 - 2 field	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	3.9 - 11.26	1 of 12		
			pH (high) SU	6.5 - 9.0 (A&Ww, PBC, AgI)	8.01 - 9.55	4 of 12		
	ADEQ & AGFD Urban Lakes MGCOR-AB 101055	1998 - 3 suites 1999 - 1 field	OK					
	Reach Summary Row A&Ww Inconclusive FC Attaining PBC Inconclusive AgI Inconclusive	1998 - 1999 28 samples 12 sampling events Missing bacteria samples	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	3.9 - 12.78	1 of 12	Attaining	ADEQ & AGFD collected a total of 12 event samples at three sites in 1998-1999. Cortez Park Lake is assessed as "attaining some uses." Add to Planning List due to pH exceedance and missing bacteria samples.
			pH (high) SU	6.5 - 9.0 (A&Ww, PBC, AgI	8.01 - 9.96	5 of 12	Inconclusive	
Eldorado Park Lake AZL15060106B-0490 A&Ww, FC, PBC	AGFD Routine Monitoring MGELP	1997 - 1 field, ammonia, nutrient	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.8	1 of 1		
	Reach Summary Row	1997 1 sampling event	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.8	1 of 1	Not assessed	Insufficient data to assess all designated uses. Add to Planning List due to low dissolved oxygen.
Encanto Park Lake AZL15060106B-0510 A&Ww, FC, PBC, AgI	AGFD Routine Monitoring MGENC	1997 - 1 suite	OK					
	Reach Summary Row	1997 1 sampling event	OK				Not assessed	Insufficient data to assess.
Fain Lake (in Lynx Creek) AZL15070101-0005 A&Ww, FC, FBC, AgL	AGFD Routine Monitoring 3 sites combined MGFAI	1997 - 1 suite 1998 - 3 suites	OK					Missing core parameters: turbidity, bacteria, some metals. Mercury Method Detection Limit was not low enough to assess Fish Consumption.
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1997 - 1998 4 event samples	OK				Inconclusive	AGFD collected 4 samples in 1997-1998. The lake is assessed as "inconclusive." Add to Planning List due to missing core parameters and mercury's Method Detection Limit.
Lake Pleasant AZL15070102-1100 A&Ww, FC, FBC, AgI, AgL	AGFD Routine Monitoring 4 sites combined MGPLE	1996 - 1 suites 1997 - 2 suites 1998 - 1 suites, 1 field 2000 - 2 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.61 - 9.3	2 of 20		Missing core parameters: dissolved metals, turbidity, bacteria, boron, beryllium, and lead. Mercury's Method Detection Limit is too high to assess Fish Consumption.
	ADEQ Lakes Program MGPLE-A 100067	2000 - 2 suites, VOCs	OK					Missing core parameters: bacteria. (same event as other ADEQ sites)

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Lakes Program MGPLE-B 100068	2000 - 2 suites, VOCs	OK					Missing core parameters: bacteria. (same event as other ADEQ sites)
	ADEQ Lakes Program MGPLE-MAR 101000	2000 - 3 VOCs, pH	OK					Only core parameter was pH.
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	**1998 - 2000** **13 samples** **9 sampling events** **Missing core parameters**	**Dissolved oxygen mg/L**	**6.0 (90% saturation) (A&Ww)**	**4.61 - 9.3**	**2 of 23**	**Attaining**	**ADEQ & AGFD collected a total of 30 samples at 6 sites. Lake assessed as "inconclusive" core parameters and sampling events.**
Lynx Lake AZL15070102-0860 A&Wc, FC, FBC, DWS, Agl, AgL	AGFD Routine Monitoring 5 sites combined MGLYN	1997 - 2 suites 1998 - 3 suites, 4 field 2000 - 2 suites	OK					Missing core parameters: turbidity, dissolved metals, bacteria, arsenic, beryllium, fluoride, barium, and boron. Mercury's Method Detection Limit is too high to assess Fish Consumption.
	Reach Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive Agl Inconclusive AgL Attaining	**1997 - 2000** **11 sampling events** **Missing core parameters**	**OK**				**Attaining**	**AGFD collected 11 samples in 1997-2000. Lake is assessed as "attaining some uses." Add to Planning List due to missing core parameters and mercury's Method Detection Limit.**
Papago Park Ponds AZL15060106B-1030 A&Ww, FC, PBC	ADEQ & AGFD Urban Lakes MGPAP-A 101047	1998 - 10 pH and DO 1999 - 2 pH and DO	OK					This site is combined with MGPAP-B & MGPAP-AB because they are not spatially independent.
	ADEQ & AGFD Urban Lakes MGPAP-B 101048	1998 - 10 pH and DO 1999 - 2 pH and DO	OK					This site is combined with MGPAP-A & MGPAP-AB because they are not spatially independent.
	ADEQ & AGFD Urban Lakes MGPAP-AB 101057	1998 - 3 suites 1999 - 1 ammonia, nutrients	OK					Missing core parameters: bacteria
	Reach Summary Row A&Ww Attaining FC Attaining PBC Inconclusive	**1997 - 2000** **16 sampling events** **Missing bacteria samples**	**OK**				**Attaining**	**ADEQ & AGFD collected 12 samples at 1 site. Lake assessed as "attaining some uses." Add to Planning List due to missing bacteria samples.**
Tempe Town Lake AZL15060106B-1588 (Standards have not yet been adopted for the lake; therefore, the lake is assessed under the Salt River designated uses) A&We, PBC	City of Tempe Sampling Aquatic Consulting Upstream Dam site MGTTL-USD	1999 - 1 suite, 14 field, 15 bacterial 2000 - 52 field, 21 bacterial	pH (high) SU	6.5 - 9.0 (A&We, PBC)	7.5 - 9.7	10 of 58		
	City of Tempe Sampling Aquatic Consulting South Shore Line site MGTTL-SSL	1999 - 1 suite, 16 field, 1 bacterial 2000 - 52 field, 1 bacterial	pH (high) SU	6.5 - 9.0 (A&We, PBC)	7.7 - 9.7	8 of 58		
	City of Tempe Sampling Aquatic Consulting Mid Lake site MGTTL-ML	1999 - 1 suite, 15 field, 16 bacterial 2000 - 52 field, 21 bacterial	pH	6.5 - 9.0 (A&We, PBC)	7.9 - 9.7	9 of 57		

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	City of Tempe Sampling Aquatic Consulting Mid-depth Downstream site MGTTL-MDD	1999 - 3 suites, 13 field 2000 - 12 suites, 40 field, 1 VOC	pH	6.5 - 9.0 (A&We, PBC)	7.8 - 9.7	8 of 57		
	City of Tempe Sampling Aquatic Consulting Downstream Dam site MGTTL-DSD	1999 - 1 suite, 16 field, 17 bacterial 2000 - 52 field, 30 bacterial	pH	6.5 - 9.0 (A&We, PBC)	7.7 - 9.7	9 of 66		
	Reach Summary Row A&We Impaired PBC Impaired	1999 - 2000 342 samples 116 sampling events	pH (high) SU	6.5 - 9.0 (A&We, PBC)	7.5 - 9.7	44 of 282	Impaired	City of Tempe's consultant collected a total of 342 samples at 5 sites in 1999-2000. Tempe Town Lake is assessed as "impaired" due to high pH readings.

Information for Interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from using AZ (for streams) or AZL (for lakes) + Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses", "Agency", and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" -- This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" -- The year and number of water samples is shown. The federal "water year is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
  - "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among samples as many different programs and agencies provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
  - "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
  - If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters
- "Standards Exceeded at this Site per Sampling Event."
  - Although many parameters may be analyzed, only those exceeding a standard are shown.
  - "OK" indicates that no standards were exceeded.
  - The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
  - "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
  - A mean or geometric mean will be shown along with the range of results if applicable to the standard.
- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or " Inconclusive." See assessment criteria in Chapter III of Volume I.

Ground Water Assessments in the Middle Gila

Major Ground Water Stressors -- Monitoring data collected from wells in this watershed between October 1995-October 2000 are summarized in **Table 17** and illustrated in **Figure 30, 31, and 32.** As **Table 17** indicates, wells are sampled for different constituents.

More than 350 wells were monitored. Of these, 321 wells were monitored in conjunction with Superfund cleanup sites with volatile and semi-volatile organic chemical contamination. **Figure 30** illustrates wells involved in these contamination areas; however, some sites are small, and therefore, difficult to illustrate on this scale map. The types of pollutants and remediation strategies for these sites is included in the following section .

Fluoride contamination seems to be occurring only in the western half of the watershed, while nitrate contamination is widespread across the watershed, and metal contamination is isolated in pockets. It is interesting to note that although significant irrigated crop production has occurred in this watershed, no pesticides were even detected in the 227 wells monitored.

TDS concentrations – Water quality can be characterized based on concentration of Total Dissolved Solids (TDS). High levels of salinity limits the practical uses of ground water in some areas of this watershed as TDS over 500 mg/L has an off-flavor, and TDS over 1000 mg/L will limit its use for some crops. Of the 94 wells monitored, 70% were over 500 mg/L and 11% were over the 1000 mg/L. As illustrated in **Figure 31**, elevated TDS occur in wells primarily located next to the Salt and Gila River, with exceptionally high levels of salinity west of Phoenix. (The Salt River was named for its natural salinity.)

No TDS water quality standards apply in this watershed, and the elevated levels of TDS do not present a human-health concern for drinking waters. The TDS concentration is only used to generally characterize water quality.

Nitrate concentrations – Water quality can also be characterized by looking at the concentration of nitrates in ground water. Naturally occurring nitrate concentrations in ground water are generally below 3 mg/L. Concentrations above 5 mg/L indicate potential anthropogenic sources of nitrate. Of the 192 wells monitored for nitrate, 57% exceeded this 5 mg/L concentration. As illustrated in **Figure 32**, these wells are scattered across the watershed. These areas may be related to historic irrigated agriculture or septic systems.

When nitrate concentrations exceed 10 mg/L, Arizona's Aquifer Water Quality Standard has been exceeded. This standard was set to protect human health ,as water with nitrate greater than 10 mg/L may present a health problem for babies and should not be consumed by nursing mothers. Forty-eight of the 192 wells monitored (25%) exceeded 10 mg/L. As many of these wells are irrigation wells (not used for drinking water), nitrates over 10mg/L may not represent a human-health concern. However, efforts should be made to minimize further contamination of ground water by nitrate.

Table 17. Middle Gila Watershed Ground Water Monitoring 1996 - 2000

MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	2		0	0%
	Fluoride	33		2	6%
	Metals/Metaloids	33		2	6%
	Nitrate	33		5	15%
	VOCs + SVOCs*	2	0	0	0%
	Pesticides	2	0	0	0
TARGETED MONITORING WELLS	Radiochemicals	14		1	7%
	Fluoride	104		16	15%
	Metals/metaloids	260		15	6%
	Nitrate	159		43	27%
	VOCs + SVOCs*	319	200	139	44%
	Pesticides	226	0	0	0%

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
94	28	27	19	10

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
192	109	35	48

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.
*The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.

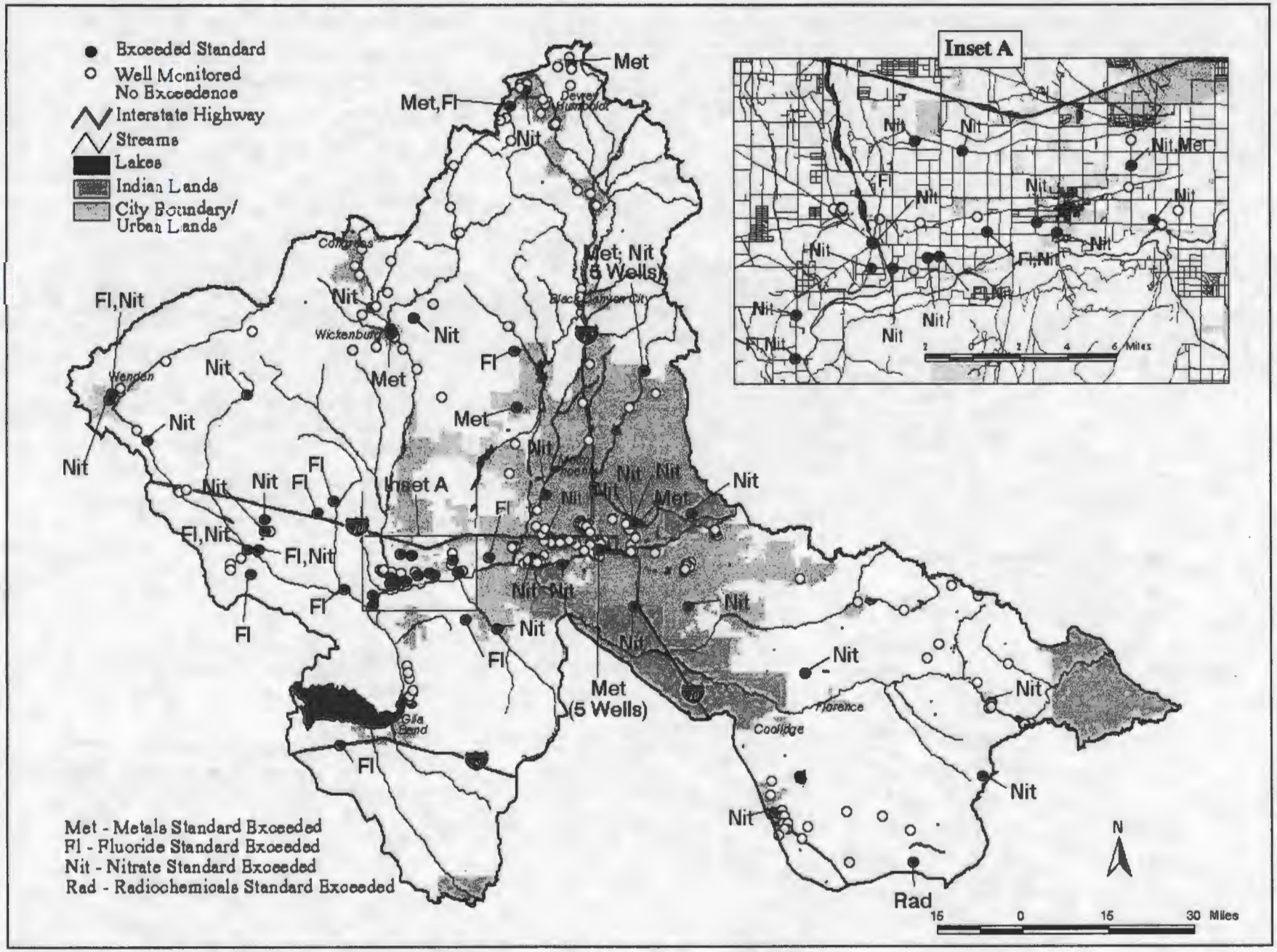

Figure 30a. Ground Water Monitoring in the Upper Gila Watershed – 1995-2000

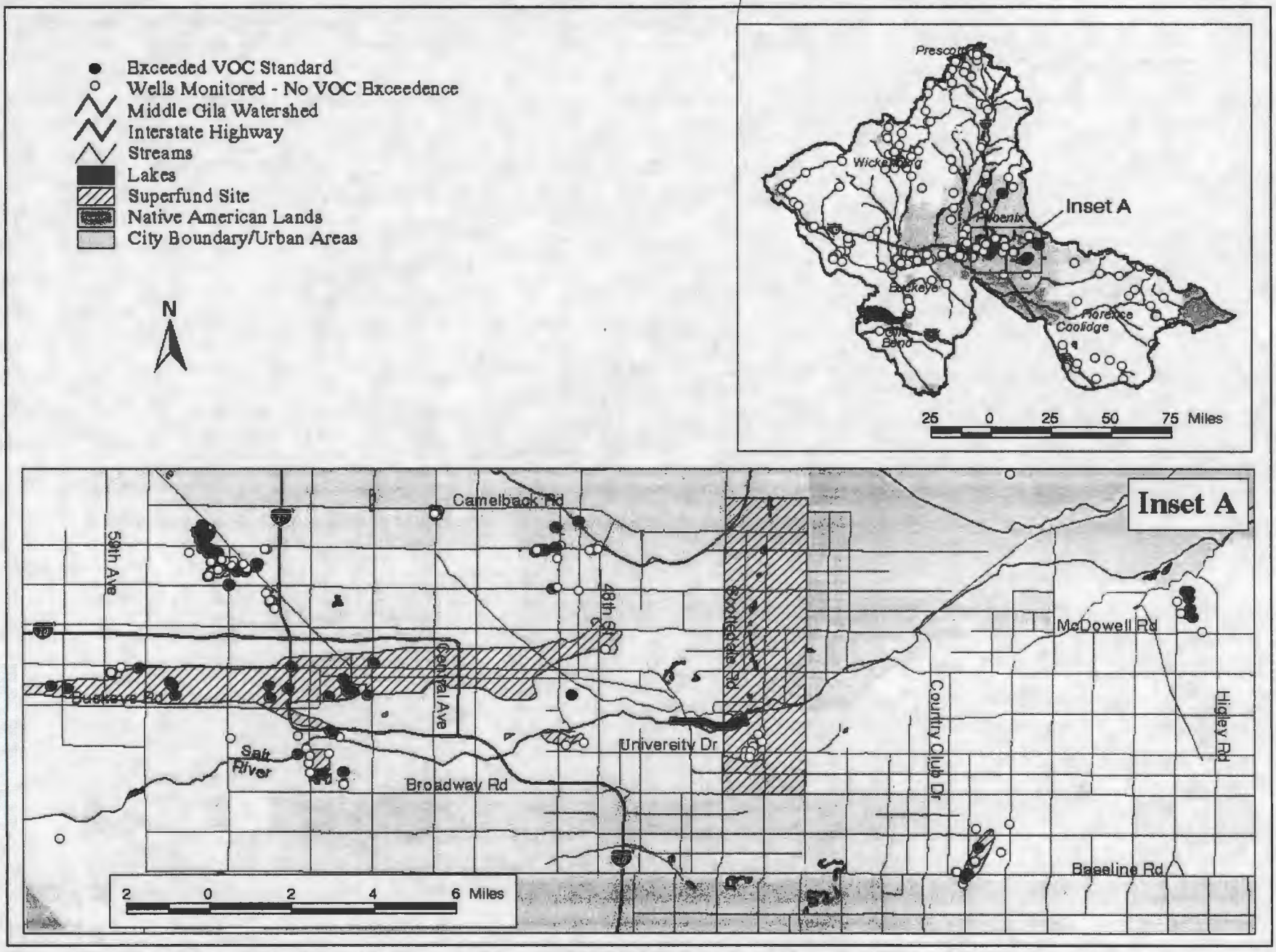

Figure 30b. Volatile and Semi-volatile Organic Compound Well Contamination in the Middle Gila Watershed

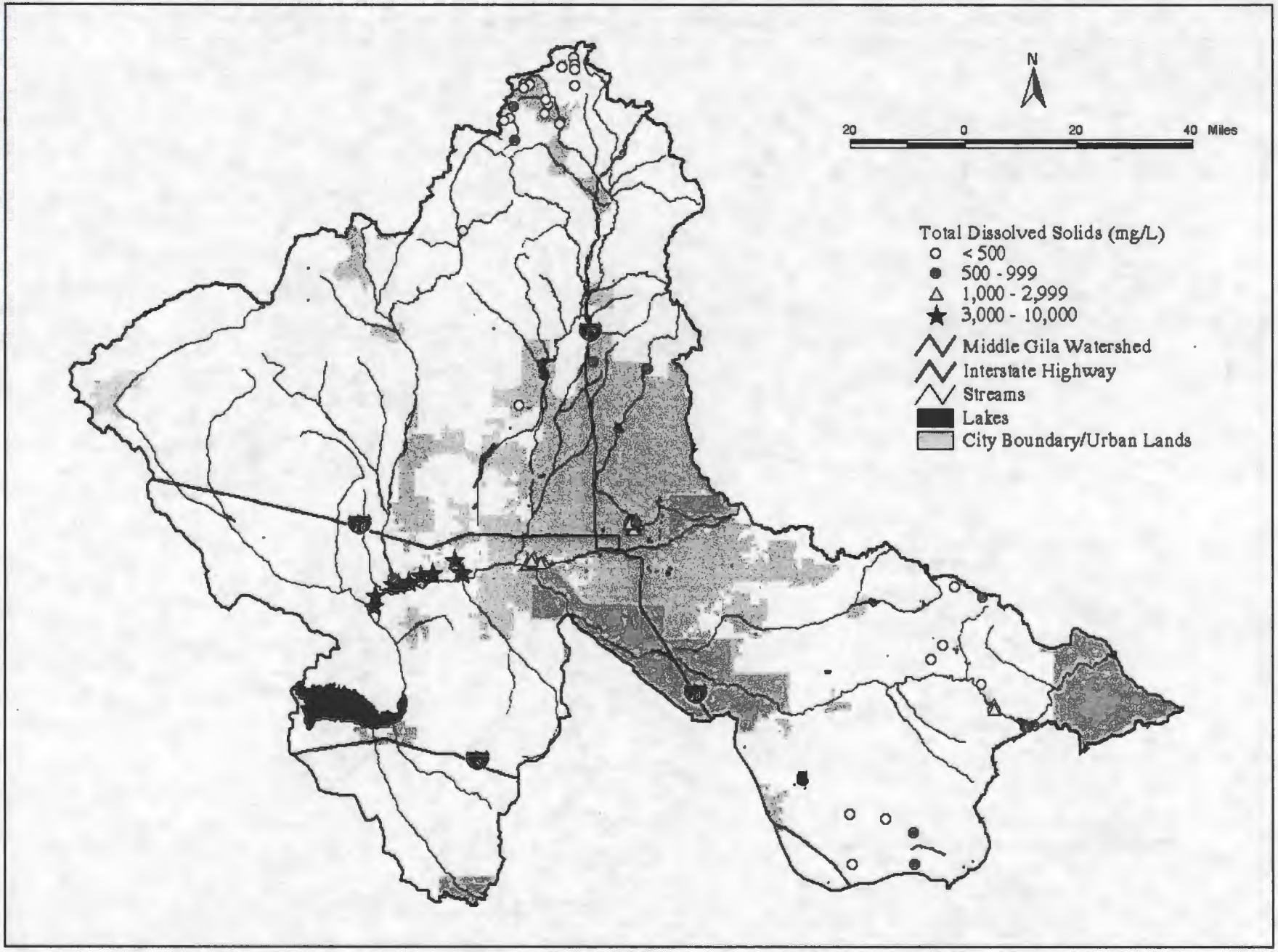

Figure 31. Classification of Ground Water Quality by TDS Concentration in the Middle Gila Watershed

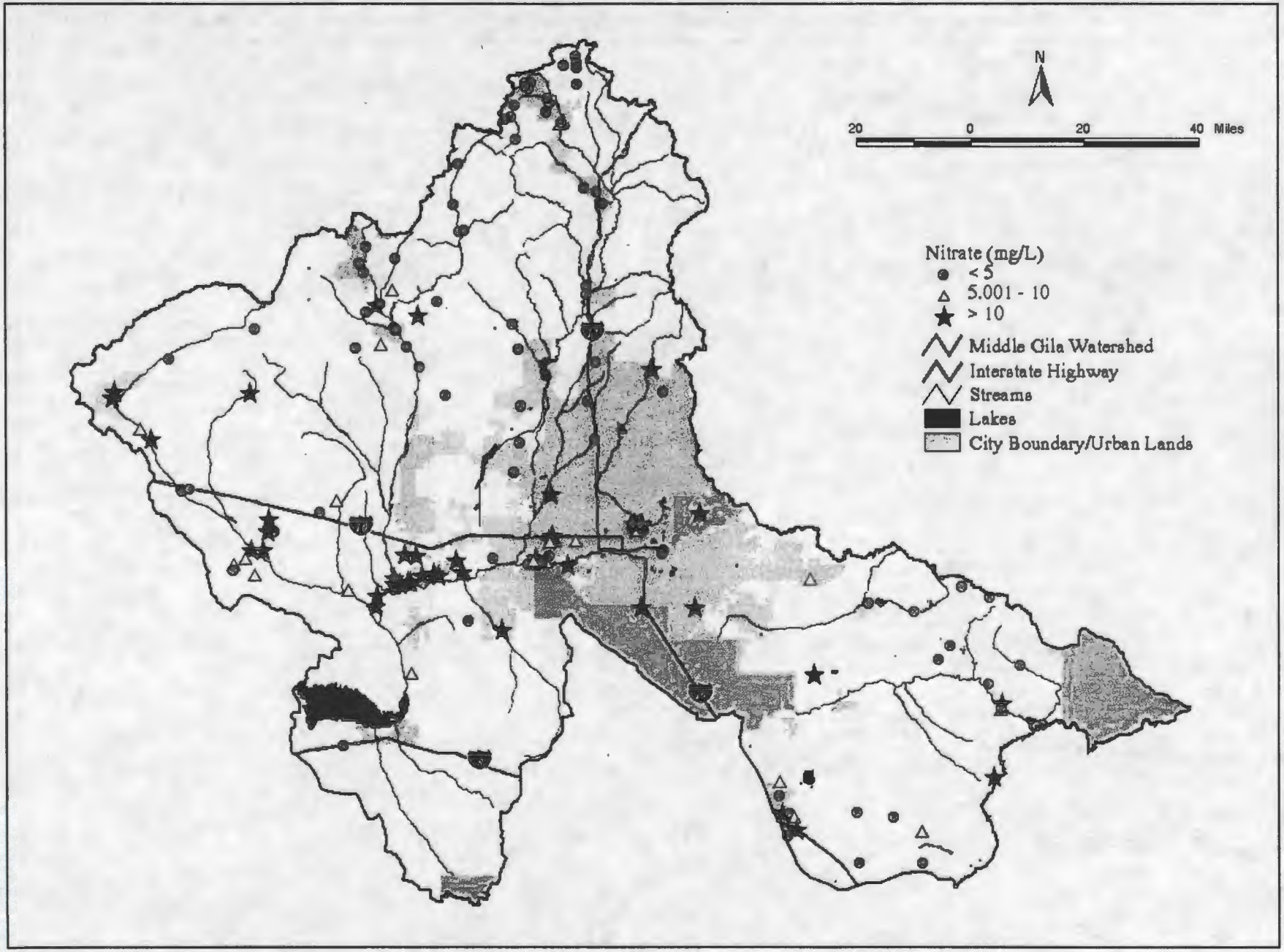

Figure 32. Classification of Ground Water Quality by Nitrate Concentration in the Middle Gila Watershed

Watershed Studies and Alternative Solutions in the Middle Gila Watershed

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the Middle Gila Watershed. Watershed partnerships active in this watershed are also mentioned.

Surface Water Studies and Mitigation Projects

Total Maximum Daily Load Studies – Several TMDL studies have been initiated in this watershed. Most are in the initial monitoring and modeling stage. Further information about the status of any of these TMDLs can be obtained by contacting the TMDL Program at (602) 207-4468 or through ADEQ's web site at: http://www.adeq.state.az.us/environ/water/assess/.

- Hassayampa River Study – The segment of the Hassayampa River from its headwaters to Blind Indian Creek, near the town of Wagoner, is included in this study area. The TMDL will determine the sources of cadmium, copper, and zinc. Several abandoned mines and tailings piles are located in this Hassayampa drainage area. One tailings pile is actually on the water's edge at the old Senator Mine.

- Turkey Creek Study – A segment from its headwaters to Poland Creek is on the 303(d) List due to arsenic, cadmium, copper, cyanide, lead, and zinc. An active mine (The Golden Turkey Mine) and numerous abandoned mines are in this drainage area. The US Forest Service and EPA are cooperating with ADEQ in collecting samples, with seven different sample locations to determine the extent and possible sources of these pollutants.

- French Gulch Study – French Gulch is a small tributary to the Hassayampa River which is on the 303(d) list due to: cadmium, copper, manganese, pH and zinc. The study area includes the inactive Zonia Mine and numerous abandoned mines. ADEQ is coordinating with Arimetco Inc., the current owner of the Zonia Mine, who is already submitting quarterly sample results for French Gulch under a compliance order. Three different sample locations below the Zonia Mine are being used to determine the extent and possible sources of pollutants.

Middle Gila River Pesticides Studies – Previous studies of fish and wildlife tissue contamination have lead to the issuance of fish consumption advisories due to four banned pesticides: DDT, toxaphene, dieldrin, and chlordane (Kepner, 1987; ADHS, 1991). Two studies have been completed to determine the status of wildlife contamination.

- U.S. Fish and Wildlife Service collected fish tissue and sediment samples in 1994 and 1995 (King, et al., 1997) along the Gila River to compare levels of pesticide and metals with the previous USFWS study in 1985 (Kepner, 1987). The new report concluded that residues of DDT have declined over the last decade but remain extremely high when compared to national averages. DDE residues were greatest in fish from agricultural drains, particularly Buckeye Canal and Dysart Drain. The number of pesticides detected in biota have also declined dramatically, with six detected in 1994-1995 versus 16 compounds in 1985.

  Eleven potentially toxic metals were detected in fish tissue. Most metals concentrations remained unchanged from the previous study. Copper concentrations in 65% of fish exceeded the national average.

  Generally, softshell turtles were more contaminated with pesticides and metals than fish. Concentrations of mercury and selenium were relatively low and do not pose a threat to fish. The greatest potential impact of contaminants is to top-level predators such as black-crowned night-herons, potentially impacting their reproductive systems.

  Although this study focused on contaminant threats to fish and wildlife, hazards to human health were also obvious. Potentially health threatening levels of DDE were present in fish fillets from Buckeye Canal and Painted Rock, exceeding the screening levels proposed by EPA and ADEQ for the protection of human health. None of the fish fillet samples exceeded the EPA guidance level for mercury. However, higher levels of mercury were found in Painted Rock Bass fillets than from Bass samples collected in the late-1980s.

- During 1999, fish tissue samples were collected by the ADEQ's Priority Pollutant Program at three sites on the Middle Gila River between Phoenix and Gillespie Dam to measure pesticide contamination levels. These samples revealed considerably lower DDT concentrations than were found in previous studies of the area; however, DDT levels were above EPA's screening concentration levels. Also, some individual samples contained high concentrations of toxaphene. Dieldrin was not found above detection levels. The recommendations generated by this study are to keep the fish advisories on the Middle Gila for DDT and toxaphene. It was also recommended that the dieldrin consumption advisory be rescinded.

Federal Permits and Compliance Monitoring – EPA and ADEQ have required three federal permit holders (NPDES and 404 permits) to do instream water quality monitoring in this watershed to determine the effectiveness of permit restrictions and remediation actions.

- The ASARCO Ray Mine complex, located along Mineral Creek, is the second largest copper mining operation in Arizona covering approximately 20-25 square miles. The 122 square mile Mineral Creek drainage area flows through this mine site. A dam about 1.5 miles above the open pits area slows surface water flow and runoff, then a tunnel diverts the flow around the open pits, returning the flow to its channel above some of the leaching facilities.

  A joint ADEQ/EPA Consent Decree in 1998 required that ASARCO build a new tunnel to divert flow from above the "Pearl Handle Pit, " a large open pit mine area, into the old diversion tunnel. The new tunnel, which is nearly compete in 2001, will also divert water flow away from some of the leaching facilities located upstream of the large open pit mine area. Mineral Creek was also concrete-lined below the old tunnel in 2001 to prevent any potential leaching contaminants from large heap leach piles to percolate into the stream channel. This consent decree occurred because of 47 point source discharges reported from August 1988 through November 1997 that have threatened water quality in Mineral Creek and violated EPA's NPDES permit conditions and the Arizona's Aquifer Protection Permit regulations. Several of the discharges have resulted in surface water quality violations for copper, pH, beryllium and cadmium. Ground water generally has cadmium and fluoride exceedances at the proposed Point of Compliance but no determination has yet been made as to whether these are natural or due to mine discharges.

  Five sample sites have been established by ASARCO to ascertain the water quality impacts to Mineral Creek potentially caused by their operation. Data from these five sample sites were used to assess Mineral Creek.
  - At Indian Gardens, above the active mining operations. This site was established to determine natural background and contributions from upstream abandoned mines.
  - Above Pearl Handle Pit and the old diversion tunnel, downstream of the "4D" waste rock deposition area and several small heap leach piles and adits. The new diversion tunnel will divert flow around this site into the old tunnel. Also, an interceptor well and pump were installed in 1998 just above this sample point.
  - At the bottom end of the old diversion tunnel.
  - Downstream of the old diversion tunnel outlet. This portion of Mineral Creek was channelized with concrete (finished in 2001).
  - Below the Highway 177 bridge, and just above the Gila River. This lower portion of Mineral Creek once again becomes a natural drainage channel.

- BHP Copper Inc. mining along Queen Creek – A storm water NPDES permit requires the mine to measure metals concentrations at two points on Queen Creek, submit a Best Management Practices plan and implement it. In June of 2000, ADEQ also recommended updating bioassessment monitoring requirements to the NPDES Permit, and these changes were incorporated into the permit. Starting in August 2000, BHP Copper Inc., agreed to take action to remove acid-generating waste rock from contact with stormwater run-off.

- City of Tempe for Tempe Town Lake in the Salt River – The Tempe Town Lake, approximately 220 acres in size, is the newest of the urban lakes in the Middle Gila watershed. This artificial lake with two inflatable rubber dams was first filled with water in June 1999. As a condition of their 404 and 401 permits Tempe is required to sample the lake's water quality monthly. Five sample points have been established. Based on more than a year of sampling the only two constituents found

to be in exceedance of state surface water standards were high pH and low dissolved oxygen. Both of these conditions are typical for urban impoundments in the Phoenix-metro area and have also been observed due to seasonal algae blooms and lake turnover.

Salt River Project (SRP) Routine Monitoring – Two rivers (the Salt and Verde), the Central Arizona Project (CAP) canal, and ground water are the source waters to SRP's canal system which supplies drinking water and irrigation water to much of the Phoenix metropolitan area. SRP conducts routine monitoring of all of these sources and shares its water quality information with its users, shareholders, and other interested parties.
Besides naturally occurring minerals, the canals were sampled for a variety of pollutants including metals, pesticides and VOCs. The samples are taken monthly as a grab sample, providing a snapshot of water quality in each canal sampled. Water quality can and does vary due to the volume and mixture of water from these sources varying seasonally, the amount and quality of agricultural return flows, Urban storm water runoff, evaporation, and seepage.

Water Protection Fund Projects – The following projects received Water Protection Funds from the Arizona Department of Water Resources.

- Picacho Reservoir Riparian Enhancement Project – Completed in 2000, this project enabled Pinal County to purchase sufficient quantities of Central Arizona Project (CAP) water over a 15-20 year period and enhance the 2,400-acre riparian and wetland habitat that currently exists within Picacho Reservoir. The habitat was periodically threatened by lack of water caused by irrigation draw-down and drought. Under this grant, Pinal County was able to establish a minimum pool within the reservoir to provide protection and enhancement of wildlife and aquatic resources.

- Assessment of the Role of Effluent Dominated Rivers in Supporting Riparian Functions – Arizona State University researchers studied sites along six reaches of three Arizona streams (two reaches per stream), where both an effluent dominated Section and a natural perennial section existed. The study concentrated on one of the selected streams and compared some of the functions of the riparian ecosystem along the effluent-dominated and non-effluent dominated reaches. The objective was to determine whether there were differences in ecosystem responses between effluent-dominated reaches and non-effluent dominated reaches. This project was completed in 1997.

- Tres Rios River Management and Constructed Wetlands Project – The Tres Rios project encompasses 5,600 acres along a portion of the Salt and Gila rivers, extending from 83rd Avenue to a downstream point at the Agua Fria River. Based on a feasibility study by the Army Corps of Engineers, this project is to establish a constructed wetland that will provide critical riparian and wetland habitats that have been lost due to water diversions and resource development in the Phoenix metropolitan area.

- Tres Rios Wetland Heavy Metal Bioavailability Design for Denitrification and Microbial Water Quality – The City of Phoenix received Watershed Protection Funds to investigate three issues identified during operation of the Tres Rios Wetland Demonstration Project:

  - Are heavy metals in the wetlands bioavailable and are there operational strategies that would mitigate or exacerbate this phenomena?
  - What is the contribution of autotrophic bacteria to the overall denitrification efficiency of the wetland and can this information be used to better estimate wetland surface area requirements? and
  - Are bacteria/pathogen concentrations due to wildlife inputs or re-growth, and what is the survivability of pathogens in a constructed wetland?

  Sampling and analysis of water, sediment, vegetation and fish tissue will be conducted to achieve the project objectives, and the findings of this study will be presented in an interpretative final report in 2001 or early 2002.

- Queen Creek Restoration and Management Plan – The town of Superior received funds to develop a Queen Creek restoration and management plan for the Queen Creek corridor. That corridor extends from its headwaters in the Tonto National Forest, through the town of Superior to the Boyce Thompson Southwestern Arboretum. The plan will address restoration of stream flow and riparian vegetation, and technical studies will be conducted to determine riparian vegetation

water needs and channel flood conveyance capacity. The project was completed in 1999.

- Wickenburg High School Stream Habitat Creation -- Wickenburg Unified School District was funded to add a recirculating stream to a wastewater treatment wetland. This would provide additional aeration to the open water portion of the treatment wetland. The applicant also proposes to create a riparian and xero-riparian vegetative community at the 15-acre project site. Over 800 mesquite, willow and cottonwood trees will be planted as well as a native shrub/scrub mixture. Basic monitoring will be conducted by students as part of the educational component of this project. The project is to be completed in 2003.

- Rio Salado Habitat Restoration Project -- The city of Phoenix Parks and Recreation Department received funds to create a vegetation demonstration project that would:

  - Test the performance of various plant materials planned for use in the greater Rio Salado project under various supplemental irrigation strategies and
  - Evaluate the treatment quality of the created wetlands for treating storm water, one of the water sources of the project.

  The greater Rio Salado project will create authentic Sonoran Desert riparian habitat, adapted for the highly altered Salt River channel as it passes through Phoenix. Phoenix will create a low-flow channel to alleviate plant kill associated with long-term inundation and to provide opportunity for aquatic strand/shrub habitat types. An estimated 5.82 million gallons per day of water will be needed to support the habitats and maintain the perennial stream in the low-flow channel.

Ground Water Studies and Mitigation Projects

Federal and State Superfund Cleanup Sites – Seven federal National Priority Listed Superfund sites, nineteen state WQARF Superfund sites, and three Department of Defense cleanup sites are located in the Middle Gila Watershed. **Figure 63b** illustrates the location of these sites. These impacts to the Middle Gila Watershed's ground water quality cannot be understated.

- 19th Avenue Landfill and the Hassayampa Landfill – Two sites are landfills that have impacted ground water and soil. Volatile organic chemicals are present in the ground water beneath each landfill and other pollutants are in the soils, including petroleum products, pesticides and heavy metals.

- North Indian Bend Wash and South Indian Bend Wash -- These two sites are the result of historical industrial operations where volatile organic chemical solvents have contaminated ground water and created large plumes, spreading beyond the points of each spill site. The ground water in the southern site is mainly contaminated with volatile organic chemicals, while soils are contaminated by VOCs cyanides, acids, and heavy metals including chromium and lead. Efforts are ongoing to remediate and remove the TCE contamination with soil vapor extraction systems, air-stripping, and ground water treatment systems.

- Motorola 52nd Street – This National Priority List site is located in a residential and commercial area in the eastern portion of Phoenix. The major contaminant of concern is the solvent TCE, a volatile organic compound which has formed a large plume in the ground water spreading to the west. Motorola is to design and implement a ground water and soil gas treatment system. Seven other parties have received general notice letters from ADEQ under the Superfund law as potentially responsible parties. This has lead one of those to conduct a remedial investigation of various volatile organic compounds, freon, and co-mingled jet fuel near Sky Harbor Airport. At the time of this writing, ADEQ is in the process of conducting a five year-review of data collected in one portion of this site to evaluate the effectiveness of current remedial actions.

- Luke Air Force Base, former Williams Air Force Base, and the Phoenix-Goodyear Airport north and south -- Three sites are located at either military or civilian airports. The contaminants include organic solvents and paint strippers, waste oil spills, petroleum spills, metal plating wastes, hydraulic fluids, pesticides, and radiological wastes. Contamination occurred due to historic disposal and storage practices.

- Seventeen other sites have impacted ground water with volatile organic chemicals. The most common volatile organic chemicals in this group

are: PCE (a common dry cleaning chemical) and TCE (formerly used in the computer manufacturing and other high tech industries). Some of these sites also have soil contamination, with constituents like pesticides, heavy metals and petroleum products.

- Vulture Mill -- Investigations at the Vulture Mill shows an average concentration of lead in the mill tailings of 5,000 mg/kg (parts per million). This exceeds Arizona's soil remediation standards of 400 mg/kg on residential property and 2000 on non-residential property. The highest concentration of lead in the tailings is reported to be approximately 11,000 µg/L.

- East Washington Fluff sites – This site is listed for lead and polychlorinated biphenyls (PCBs) above regulatory levels. ADEQ initiated an early response action for the this former auto shredder facility. Contaminated soil was removed, and clean fill and gravel was placed on top as a protective cap.

- The Gila Bend Auxiliary Air Field -- In 1994, the US Air Force conducted site investigations of two sites at this facility: the former fire training area and a nearby maintenance area. Limited contamination was found at the former fire training area, with a determination that it did not pose a threat to ground water. Sampling of the maintenance area did not reveal any contamination warranting further action.

- The 161st Air National Guard – Past aircraft maintenance and fueling operations at the site have led to surfaee and subsurface soil and ground water contamination with petroleum products and volatile organic compounds.

- The Papago Military Reservation -- This site is listed due to jet fuel; however, the extent of contamination remains undefined.

The Prescott Active Management Area Baseline Monitoring Study – Situated in Yavapai County, the Prescott Active Management Area encompasses more than 485 square miles. (See discussion of Active Management Areas and ground water basins in Section II of this report.) This AMA is situated in both the Middle Gila and Verde watersheds. ADEQ conducted baseline monitoring in 1997-1998 to look at the heavy reliance on ground water supplies, ground water management decrees which require reaching sustainable levels (safe-yield) by 2025, a large increase in population, and the associated number of wells used to extract ground water.

The Prescott AMA consists of two sub-basins, (the Little Chino and the Upper Agua Fria), and two aquifers (the regional aquifer located in valley alluvial areas and the hardrock aquifer located in mountainous areas). Ground water quality differences were found between each sub-basin and each aquifer.

The study concluded that the 58 sites sampled in the Prescott AMA generally met water quality standards. Of the sites, 90 percent sampled met health-based standards and 85 percent met aesthetics-based standards. Aquifer protection standards were exceeded at scattered well sites and did not appear to indicate extensive areas of ground water that are unsuitable for domestic use. Fluoride and arsenic were the parameters that most frequently exceeded standards and these elevated levels appear to be the result of naturally occurring conditions.

Salt River Project (SRP) Ground Water Monitoring – (See prior discussion) SRP's 248 ground water wells help satisfy customer needs in Phoenix metropolitan area. SRP ground water is pumped from wells into canals or laterals, where mixing and dilution with surface water occurs. SRP tests for organic, inorganic constituents, and trace metals.

Prescott Mining Project – This EPA funded study was to characterize the impacts to surface and ground water from inactive and abandoned mines within a 500 square mile area located in the Bradshaw Mountains, Yavapai County, Arizona. The US Forest Service, the U.S. Bureau of Mines, and ADEQ cooperated in this investigation. As a result of the partnership, the project was modified to focus on inactive and abandoned mining impacts on water quality and biota in the lower Turkey Creek drainage area.

In 1994-1995, 25 sites were sampled up to three times in the lower Turkey Creek drainage area. Surface and ground water samples, geophysical surveys, and tailings (soil) samples were collected. Samples taken directly from the tailings piles indicated extremely high levels of arsenic and lead; however, water samples taken directly below these tailings piles and downstream did not reveal elevated levels of heavy metals during the three sampling events. A previous study at the Golden Turkey Mine in 1991 (a large abandoned mine along Turkey Creek) detected exceedances for arsenic, cyanide and mercury. This Prescott Mining Study concluded that the tailings do represent a significant potential source of contamination to Turkey Creek, which may only occur during rainfall/runoff

events. Further, transport of these pollutants downstream to the Agua Fria River and Lake Pleasant pose a potential threat to human health and the environment.

The report recommended that the Golden Belt and Golden Turkey mines should be the first priority for remediation in the lower Turkey Creek drainage area. Since project and equipment costs can be significant, that remedial action should be undertaken after assessments of risk is completed at other mine sites in the vicinity. Further, a study should be initiated to determine impacts of downstream migration of contaminated sediments.

Watershed Partnerships

The Upper Agua Fria Watershed Partnership – This partnership was formed in 2000 under ADWR's Rural Watershed Initiative. This partnership is made up of supporting federal and state agencies and stakeholder groups, including: the Bureau of Land Management, the Natural Resources Conservation Service, US Fish and Wildlife Service, US Forest Service, US Geological Survey, ADEQ, ADWR, Arizona Game and Fish Department, Arizona State Land Department, Arcosanti, Big Bug Economic Alliance, Big Bug Watershed Group, Mothers for Clean Water, Sonoran Audubon Society, Spring Valley Homeowners Association, University of Arizona and Yavapai County Water Advisory Committee.

Three key watershed issues have been identified by the partnership: water quantity, water quality, and water legal rights issues. Specific issues included the fast growth and development of the Prescott Active Management Area (AMA), ranching issues, leaking underground storage tanks, and potential MTBE pollution near Cordes Junction. The issue of diminished water quality due to illegal wildcat dumps near and in the river systems has become very important, and the partnership plans to address this issue with a Water Quality Improvement Grant in 2001 to clean up several small wildcat dump sites along the Big Bug Creek and the Agua Fria River.

The UAFWP received $25,000 in 2000 from the ADWR and State Legislature Rural Watershed Alliance Funds to conduct and compile a hydrological assessment of the Upper Agua Fria Sub-watershed (not including areas within the Prescott or Phoenix Active Management Areas). The research is being conducted by the University of Arizona's School of Renewable Resources. The report is to be finalized in the near future.

The partnership also received $25,000 (2001) from the Rural Watershed Alliance Funds for a ground water study by University of Arizona for the Upper Agua Fria Sub-watershed, to help augment the on-going hydrologic study already being conducted.

Recently the partnership was successful in working with ADEQ and Yavapai County to have several tons of soil with asphalt chunks removed from Big Bug Creek. This occurred because the partnership brought the recent deposit of these waste materials in Big Bug to the attention of ADEQ and Yavapai County.

For information about future meeting, contact Mary Hoadley at earthhous@aol.com or by phone at Arcosanti, Arizona (520) 632-6229.

The Tres Rios River Management Plan Steering Committee – The Tres Rios group was formed in 1994. The planning, design, and implementation phase of the Tres Rios Project required the cooperation of a large number of federal, state, city, and county agencies and other interested parties, including: Phoenix, the Corps of Engineers, the Bureau of Land Management, Glendale, Mesa, Phoenix, Scottsdale, Tempe and Tolleson, Arizona Municipal Water Users Association, Arizona State University, Gila River Indian Community, Greeley and Hansen, Maricopa County Flood Control District, and Science Applications International Corporation, Arizona Game and Fish Department, ADEQ, Maricopa County Department of Parks and Recreation, Maricopa County Flood Control District, and the United States Environmental Protection Agency.

The Tres Rios Project is a constructed wetland at the convergence of the Salt, Gila, and Agua Fria rivers (tres rios being Spanish for "three rivers"). It was conceived of so that the largest wastewater treatment plant serving the Phoenix metropolitan area could meet more stringent surface water quality standards and to provide additional treatment capacity. The wetlands were to provide water treatment for the 91st Avenue WWTP, create wildlife habitat, and provide for flood protection for downstream residents.

The objectives of the first phase of the Tres Rios Project were to:

- Test the capability of constructed wetlands to treat effluent to meet the expected future National Pollutant Discharge Elimination System (NPDES) requirements,
- Develop appropriate design criteria for a future full-scale 800-acre wetland project in the Tres Rios area, which would treat the entire 150

million gallons per day of effluent discharged by the plant, and

- Assess the net environmental benefit it would have on the three river area.
- Enhance wildlife habitat,
- Provide an education and passive recreation resource for the community.

Along with the development of this constructed wetland, this interagency committee has:

- Developed a database of existing water quality data (inorgainc, organic, pesticides, PCBs, and dissolved oxygen)
- Identified potential water quality sources of contaminants: flood flows, agricultural storm water runoff, agricultural irrigation drainage and dewatering, discharges from concentrated animal feeding operations, wastewater treatment plant discharges, landfill leachate, ground water inflow, and sand and gravel releases.
- US Army Corps of Engineers prepared the *Tres Rios, Arizona Feasibility Study* (2000). The study focused on efforts to improve fish and wildlife habitat values and diversity for threatened and endangered species. Potential incidental benefits for flood damage reduction, water quality, water supply and recreation were also evaluated.
- Two Geographic Information System (GIS) projects have been completed in 2001 by two private consultants to help characterize the Tres Rios area, the confluence of the Middle Gila, the Salt and the Agua Fria rivers. These GIS projects attempted to inventory the various elements that could potentially impair the rivers water quality, including NPDES permitted sites, CAFOS and storm water inputs. These GIS projects are available on CD-ROM.

The main contact for this group is Dick Perault with the Maricopa County Flood Control District (MCFCD). More information can be obtained at the Tres Rios web site: http://www.tresrios.net/backgrou.html.

Salt Watershed

SALT WATERSHED CHARACTERIZATION				
SIZE	6,242 square miles (5% of the State's land area).			
POPULATION BASE	Approximately 40,500 people live in this watershed (estimated from the 2000 census). This is approximately 1% of the state's population.			
LAND OWNERSHIP **(Figure 33)**	Tribal	49%	Private	2%
	U.S. Forest Service	47%	Other state and federal	2%
LAND USES AND PERMITS **(Figure 34)**	Except for the Miami-Globe mining district, the basin is sparcely populated. Principal land uses on National Forest lands are recreation, grazing, and silviculture, with mining centralized in the Superior-Miami-Globe area. There are nine designated wilderness areas in this basin with restricted land uses and activities.			
HYDROLOGY AND GEOLOGY	This watershed is defined by the Salt River drainage area from its headwaters to Granite Reef Dam, excluding the Verde River drainage area. The Salt River drainage area below Granite Reef Dam is included in the Middle Gila Watershed because the water in the Salt River is normally diverted at Granite Reef Dam into a system of canals and becomes hydrologically disconnected from its natural fluvial system. The watershed contains four surface water sub-basins: White River, Black River, Tonto River, and the Salt River. The perennial water in the White River and Black River sub-basins provides much of the water used in the Phoenix metropolitan area. Flow in the Salt River above Roosevelt Lake varies between 59 cfs (in 1955) to 143,000 cfs (in 1993), with an average annual flow of 929 cfs (USGS 1996). Ground water basins include: Tonto Creek Basin and the Salt River Basin, with a very small portion of the Phoenix Active Management Area. This watershed is primarily within the Central Highlands Province. The western portion of this watershed consists of rugged mountains, composed of igneous, metamorphic, and sedimentary rocks along with unconsolidated sediments that accumulate in the larger valleys. Groundwater occurs to some extent in these formations, although the amount varies widely depending on composition and structure of the rocks. Unconsolidated sands and gravel, which occur within the floodplain of streams and washes, are generally the most productive aquifers (ADWR 1994). The eastern portion of this watershed is dominated with volcanic materials such as basalt flows, cinder beds, tuffaceous agglomerates, and tuffs. Limited amounts of groundwater occur most predominately in cinder beds, fracture zones, and weathered zones (ADWR 1994). Due to the high elevations, steep gradients, and a predominance of hardrock, the entire watershed has high runoff and minimal natural water storage capabilities. Therefore the area is very susceptible to both drought and heavy groundwater pumping (ADWR 1994).			
UNQUE WATERS	None			
ECOREGIONS	Arizona-New Mexico Mountains			
OTHER STATES, NATIONS, OR TRIBES	This watershed drains to the Middle Gila Watershed. White Mountain Apache, San Carlos Apache, and Salt River Indian tribes are significant stakeholders in this watershed as they own 49% of the land area.			

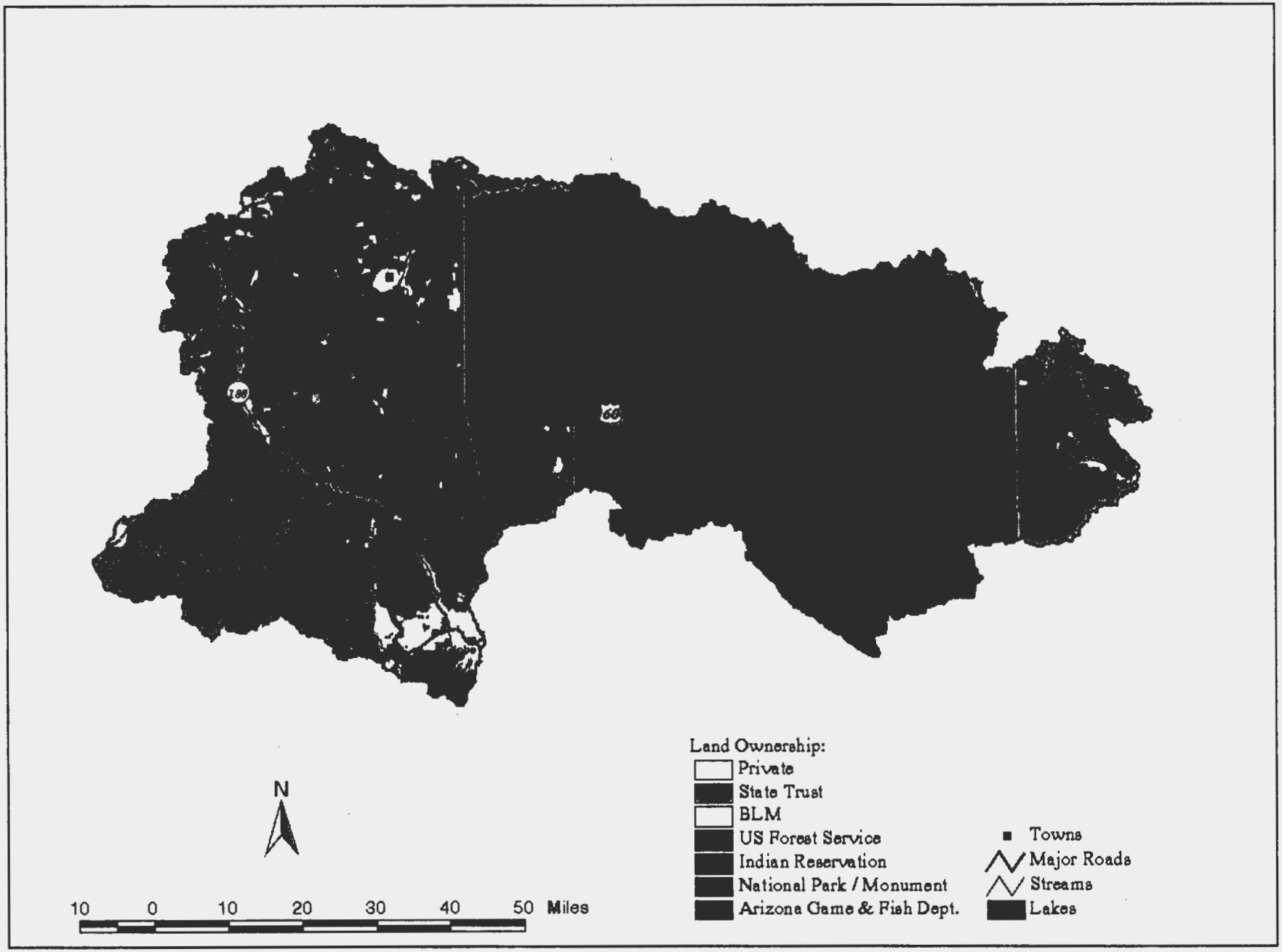

Figure 33. Land Ownership in the Salt Watershed

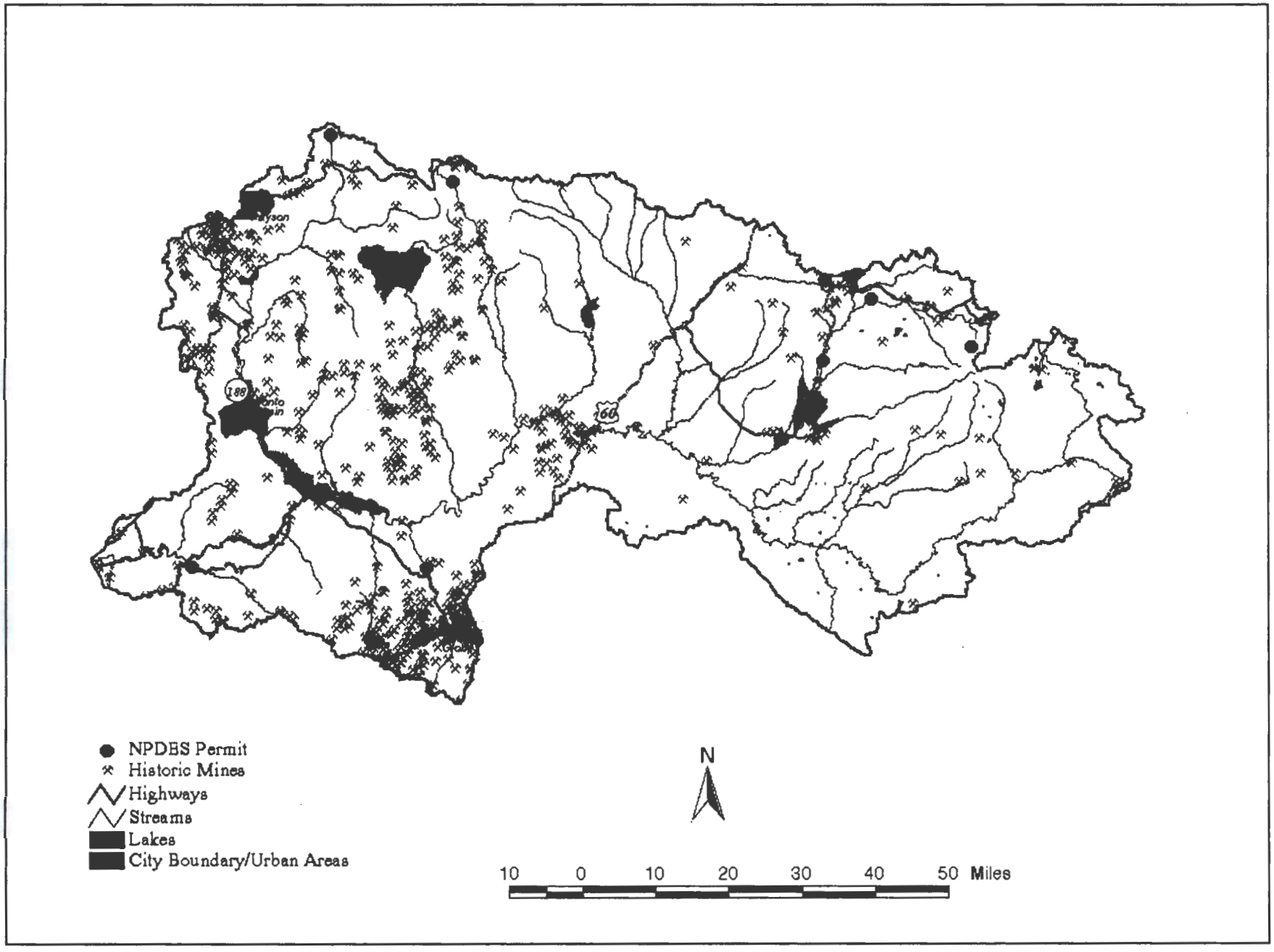

Figure 34. General Land Use and NPDES Permits in the Salt Watershed

Salt Watershed Assessment Discussion

Statistical Summary of Surface Water Assessments

Assessments – For the 2002 assessment, 193 miles of streams or washes, and 22,186 acres of lakes were assessed. Fewer assessment were completed than previously because of two factors: 1) changes in assessment criteria requiring more data to base an assessment, and 2) a lack of current credible data. This watershed will have additional water quality monitoring collected in 2002 and this new data will be included in the next assessment cycle.

Water quality assessment information for the Salt Watershed is summarized in the following tables and illustrated on **Figure 35**.

Table 18. Assessments in the Salt Watershed – 2002

	STREAMS		LAKES	
	miles	number of segments	acres	number of lakes
ATTAINING	58	4	1,022	1
INCONCLUSIVE	68	2	21,164	5
IMPAIRED	47	6	0	0
NOT ATTAINING	20	1	0	0
TOTAL ASSESSED	193	13	22,186	6

PERENNIAL SURFACE WATERS ASSESSED		STREAMS		LAKES	
		miles	number of segments	acres	number of lakes
	Assessed	154	9	22,187	6

* Note that streams with significant perennial stretches within the reach assessed were included in the perennial milage although part of the reach may have ephemeral or intermittent flow.

Inconclusive assessments – Surface waters with some monitoring data, but insufficient data to determine if a designated use is attaining or impaired, were added to the new Planning List. By the end of the next watershed monitoring cycle (scheduled in 2007), ADEQ expects to monitor these reaches and lakes so that all designated uses can be assessed during the following assessment cycle. Other lakes and streams which lack water quality monitoring data will be monitored depending on resources and priorities.

ADEQ will be working with US Geological Survey and the Arizona Game and Fish Department, so that their future monitoring will better support Arizona's surface water assessments.

Major stressors – When a surface water is listed as impaired or not attaining a designated use, the pollutants or suspected pollutants causing the impairment are identified. The seven stream reaches assessed as impaired or not attaining a use can be divided into two groups based on pollutants and their probable sources:

- Historic mining activities have caused impairment of 37 miles of stream reaches in the Pinal Creek and Pinto Creek drainage area due to copper, manganese and/or low pH.
- Turbidity exceeds standards along Tonto Creek and a tributary, Christopher Creek.

Watershed assessment map
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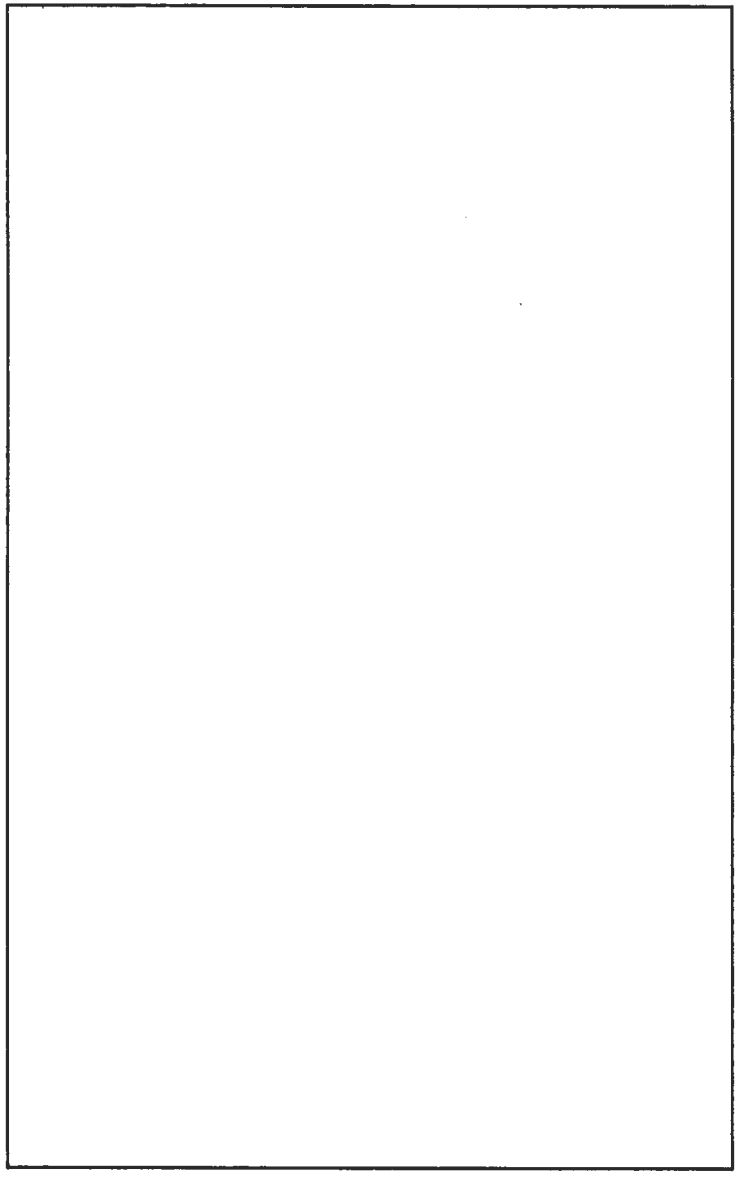

TABLE 19. SALT WATERSHED – DATA MONITORING – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
STREAM MONITORING DATA								
Bear Wallow Creek North Fork headwaters-Bear Wallow AZ15060101-022 A&Wc, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Above South Fork Bear Wallow Creek SRNBE000.54 100605	1998 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Black River West Fork headwaters-Black River AZ15060101-048 A&Wc, FC, FBC, DWS, AgI, AgL	ADEQ Biocriteria Program West Fork above Thompson Creek SRWFB011.08 100692	1998 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Campaign Creek headwaters-Pinto Creek AZ15060103-037 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program At Superstition Wilderness boundary SRCGN007.70 100431	1996 - 1 suite	OK					
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Canyon Creek headwaters-Oak Creek AZ15060103-014 A&Wc, FC, FBC, DWS, AgI, AgL	ADEQ Biocriteria Program Above Valentine Canyon SRCYN031.50 100528	1997 - 1 suite	OK					
	Reach Summary Row	1997 1 sampling event	OK				Not assessed	Insufficient data to assess.
Cherry Creek headwaters-Salt River AZ15060103-015 A&Wc, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Above Turkey Creek SRCHE024.73 100441	1997 - 1 suite	OK					Missing core parameters: some metals, bacteria, boron
	ADEQ Biocriteria Program Above Devil's Chasm SRCHE011.08 100442	1996 - 1 field + nutrients + NH3	OK					Missing core parameters: no metals, bacteria and boron
	Reach Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	1996 - 1997 2 sampling events Missing core parameters	OK				Inconclusive	ADEQ collected a total of 2 samples at two sites in 1996-1997. Reach is assessed as "inconclusive" due to missing core parameters and lack of sampling events.

TABLE 19. SALT WATERSHED – DATA MONITORING – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Christopher Creek headwaters-Tonto Creek AZ15060105-353 A&Wc, FC, FBC, AgI, AgL	ADEQ Intensive Survey At See Springs (Headwaters) SRCRS003.26 100361	1996 - 2 suites, 1 bact	Ok					Missing core parameters: no boron or metals.
	ADEQ TMDL Program Upstream from recreation area SRCRS6.04 101027	2000 - 3 suites, 3 bact	Ok					
	ADEQ Intensive Survey Near See Springs Trail head parking - middle reference site SRCRS002.90 100436	1996 - 1 suite	Ok					
	ADEQ TMDL Program Downstream from recreation area SRCRS5.70 101028	2000 - 3 suites, 3 bact	Ok					
	ADEQ Intensive Survey Investigation Above Highway 260 SRCRS002.48 100362	1996 - 1 suite, 1 bact	Ok					
	ADEQ TMDL Program Above settlement of Christopher & Highway 260 Bridge SRCRS4.47 101029	2000 - 3 suites, 3 bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.7 - 9.7	1 of 3		Missing core parameters: no boron or metals. Low dissolved oxygen is natural during low flows & presence of groundwater upwelling. Exceedances not included in the final assessment.
	ADEQ Intensive Survey Investigation Below Christopher Creek Community SRCRS001.91 100363	1996 - 2 suites, 1 bact	Ok					Missing core parameters: no boron or metals.
	ADEQ TMDL Program By triangular cross-section cut through bedrock SRCRS3.56 101030	2000 - 3 suites, 3 bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.7 - 10.4	1 of 3		Missing core parameters: no boron or metals. Low dissolved oxygen is natural during low flows & presence of groundwater upwelling. Exceedances not included in the final assessment.
	ADEQ Intensive Survey Investigation Above Campground SRCRS001.56 100364	1996 - 2 suites, 1 bact	Ok					Missing core parameters: no boron or metals.

TABLE 19. SALT WATERSHED – DATA MONITORING – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ TMDL Program Above Christopher Creek Campground and below Hunter Creek SRCRS2.85 101031	2000 - 3 suites, 3 bact	Turbidity NTU	10 (A&Wc)	0 - 12.73	1 of 3		
	ADEQ Intensive Survey Investigation Below Tonto National Forest Campground SRCRS001.27 100365	1996 - 2 suites, 1 bact	Ok					
	ADEQ TMDL Program Below Christopher Creek Campground, above Boy Scout Ranch SRCRS2.26 101032	2000 - 3 suites, 3 bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.8 - 8.1	1 of 3		Missing core parameters: no boron or metals. Low dissolved oxygen is natural during low flows & presence of groundwater upwelling. Exceedances not included in the final assessment.
			Turbidity NTU	10 (A&Wc)	0 - 13.97	2 of 3		Missing core parameters: no boron or metals.
	ADEQ Intensive Survey Investigation Below R-C Ranch SRCRS000.86 100366	1996 - 2 suites, 1 field (5 consecutive days of bacteria samples)	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.5 - 8.86	1 of 3		Missing core parameters: no boron or metals.
			Escherichia coli CFU/100 ml	580 (FBC) 130 Geometric mean (FBC)	68 - 3800 (978 geometric mean)	1 of 2 Geometric mean		Missing core parameters: no boron or metals. 5 consecutive days of bacteria samples is sufficient to calculate a geometric mean.
			Turbidity NTU	10 (A&Wc)	1.61 - 894	1 of 2		Missing core parameters: no boron or metals.
	ADEQ TMDL Program At top of Box Canyon below RC Boy Scout Ranch SRCRS1.24 101033	2000 - 3 suites, 3 bact	Escherichia coli CFU/100 ml	580 (FBC)	1 - 689.3	1 of 3		Missing core parameters: no boron or metals.
			Turbidity NTU	10 (A&Wc)	0 - 88.63	2 of 3		
	ADEQ FSN Intensive Survey Below Box Canyon SRCRS000.18 100367	1996 - 1 suite 1999 - 1 nutrients	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.98 - 7.4	1 of 1		Missing core parameters: no boron or metals.
			Escherichia coli CFU/100 ml	580 (FBC)	430 - 600	1 of 1		
			Turbidity NTU	10 (A&Wc)	80 - 294	1 of 1		

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ TMDL Program Above Tonto Creek, Below Box Canyon SRCRS0.08 101034	2000 - 3 suites	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.3 - 7.7	1 of 3		Missing core parameters: no boron or metals. Low dissolved oxygen is natural during low flows & presence of groundwater upwelling. Exceedances not included in the final assessment.
			Turbidity NTU	10 (A&Wc)	0 - 13.77	2 of 3		Missing core parameters: no boron or metals.
	Reach Summary Row A&Wc Impaired FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	1996 - 2000 39 sampling events Missing core parameters	Dissolved oxygen - mg/L	7.0 (90% saturation) (A&Wc)	5.5 - 10.4	3 of 38	Attaining	ADEQ collected a total of 39 samples at 16 sites in 1996-2000. Reach assessed as "impaired" due to turbidity. Add to Planning List due to bacteria exceedances and missing core parameters.
			Escherichia coli CFU/100 ml	880 (FBC)	1 - 3800	3 of 32	Attaining	
				130 Geometric mean (FBC)	978	1 exceedance	Inconclusive	
			Turbidity NTU	10 (A&Wc)	0 - 894	9 of 32	Impaired	
Deer Creek headwaters-Rye Creek AZ15060105-018 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program At Mazatzal Wilderness Boundary SRD4E003.91 100531	1996 - 1 suite	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	3.2	1 of 1		Naturally occurring low dissolved oxygen at low flows (0.1 cfs). Exceedance is not included in the final assessment.
	Reach Summary Row	1996 1 sampling event					Not assessed	Insufficient data to assess.
Devil's Chasm Creek headwaters-Cherry Creek AZ15060103-801 A&Wc, FC, FBC	ADEQ Biocriteria Program Above Cherry Creek SRDEV000.29 100533	1996 - 1 suite	OK					
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Fish Creek AZ15060106A-583 A&Ww, FC, FBC	ADEQ Biocriteria Program 0.25 miles upstream of Highway 88 SRFSH004.06 100552	1997 - 1 suite	OK					
	Reach Summary Row	1997 1 sampling event	OK				Not assessed	Insufficient data to assess.
Fish Creek headwaters-Black River AZ15060101-032 A&Wc, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Near Bear Wallow Wilderness SRFIS002.53 100553	1997 - 1 suite	Copper (dissolved) µg/L	varies with hardness (A&Wc)	<1.0 - 33	1 of 1		
	Reach Summary Row	1997 1 sampling event	Copper (dissolved) µg/L	varies with hardness (A&Wc)	<1.0 - 33	1 of 1	Not assessed	Insufficient data to assess. Add to Planning List due to copper exceedance.

TABLE 19. SALT WATERSHED – DATA MONITORING – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Haigler Creek headwaters-Tonto Creek AZ15060105-012 A&Wc, FC, FBC, AgI, AgL	ADEQ Biocriteria Program 1.4 miles below Alderwood Recreation site SRHAG003.51 100563	1997 - 1 suite	OK					
	Reach Summary Row	1997 1 sampling event	OK				Not assessed	Insufficient data to assess.
Haunted Canyon headwaters-Pinto Creek AZ15060103-879 A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Program 0.25 miles below Powers Gulch above Pinto Creek SRHNC000.40 101131	2000 - 1 metals	OK					Missing core parameters: metals only sampled, insufficient parameters to assess all designated uses. Beryllium: The beryllium sample from this site was excluded because the Method Detection Limit (MDL) was higher than the standard of 0.21 This sample was not added to the summary row below.
	ADEQ TMDL Program Haunted Canyon at Carlota Weir HC-4 SRPNT000.20 101072	2000 - 1 metals	Beryllium µg/L	0.21 (FC)	0.58	1 of 1		Missing core parameters: metals only sampled, insufficient parameters to assess all designated uses.
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	2000 2 sampling events Missing core parameters	Beryllium µg/L	0.21 (FC)	0.58	1 of 1	Inconclusive	ADEQ collected a total of 2 samples at 2 sites. Reach assessed as "inconclusive" and should be added to the Planning List due to beryllium exceedance, missing core parameters and lack of sampling events.
Hunter Creek AZ15060105-354 A&Wc, FC, FBC, AgL	ADEQ Fixed Station Monitoring Above Christopher Creek SRHUN000.07 100368	1996 - 1 suite	OK					
	Reach Summary Row	1996 1 sampling event					Not assessed	Insufficient data to assess.
Pinal Creek Radium-Setka Ranch AZ15060103-280C A&We, PBC, AgL	USGS From LPC treatment plant above Head of Flow (HOF) (Outfall Site)	2000 - 3 suites	OK					Missing core parameters: no nutrients, turbidity, bacteria, and some metals.

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	USGS Open File Report 97-247 At Head of Flow (HOF) SRPNL006.64	1996 - 6 suites 1997 - 6 suites 1998 - 5 suites 1999 - 7 suites	Copper (dissolved) µg/L	varies with harness (A&We)	<30 - 200	2 of 24		Missing core parameters: no nutrients, turbidity, bacteria, and arsenic.
			Fluoride mg/L	8.4 (PBC)	0.5 - 8.7	1 of 23		
			Manganese (total) µg/L	19,600 (PBC)	25000 - 66900	24 of 24		
			pH (Low) SU	6.5 - 9.0 (A&We, AgL)	5.4 - 6.5	23 of 24		
	USGS Below Head of Flow (HOF) (D1.5. sw Site)	1999 - 1 suites	Manganese (total) µg/L	19,600 (PBC)	68300	1 of 1		Missing core parameters: no nutrients, turbidity, bacteria, some metals.
			pH (Low) SU	6.5 - 9.0 (A&We, AgL)	5.5	1 of 1		
	USGS Open File Report 97-247 At Setka Ranch (Z0 Site) SRPNL005.38 USGS #09498380	1996 - 6 suites 1997 - 6 suites 1998 - 5 suites 1999 - 7 suites 2000 - 3 suites	Copper (dissolved) µg/L	varies with hardness (A&We)	<10 - 283	14 of 27		Missing core parameters: no nutrients, turbidity, bacteria, and arsenic.
			Manganese (total) µg/L	19,600 (PBC)	66 - 74700	24 of 27		
			pH (Low) SU	6.5 - 9.0 (A&We, AgL)	5.5 - 7.5	23 of 27		
	USGS 4 sample points below Head of Flow (HOF) (Z1.sw site)	1998 - 1 suite 1999 - 1 suite	Copper (dissolved) µg/L	varies with hardness (A&We)	30 - 220	1 of 2		Missing core parameters: no nutrients, turbidity, bacteria, some metals.
			Manganese (total) µg/L	19,600 (PBC)	57800 - 65600	2 of 2		
			pH (Low) SU	6.5 - 9.0 (A&We, AgL)	5.9 - 6.2	2 of 2		
	Phelps Dodge/Pinal Creek Group WQARF Monitoring At See Ranch SRPNL004.68	1998 - 1 metals, pH 1999 - 12 metals, pH 2000 - 12 metals, pH	Cadmium µg/L	50 (AgL)	<1 - 55	1 of 25		Data was not included in the final assessment as the Sampling and Analysis Plans and Quality Assurance Plans could not be located. Including or not including these results did not affect the final assessment.
			Copper (dissolved) µg/L	varies with hardness (A&We)	<10 - 140	1 of 25		
			Manganese (total) µg/L	19600 (PBC)	<50 - 74900	14 of 25		
			pH (Low) SU	6.5 - 9.0 (A&We, AgL)	5.4 - 7.2	12 of 25		

TABLE 19. SALT WATERSHED -- DATA MONITORING - 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row A&We Impaired PBC Impaired AgL Impaired	1996 - 2000 83 total samples 80 sampling events Missing core parameters	Copper (dissolved) ug/L	varies with hardness (A&We)	<10 - 283	17 of 82	Impaired	USGS and Pinal Creek Group collected a total of 83 samples at 6 sites in 1996-2000. Reach assessed as "impaired" due to copper, manganese and low pH.
			Fluoride mg/L	8.4 (PBC)	0.5 - 8.7	1 of 58	Attaining	
			Manganese (total) ug/L	19600 (PBC)	<50 - 74900	53 of 82	Impaired	
			pH (Low) SU	6.5 - 9.0 (A&We, AgL)	5.4 - 7.5	49 of 83	Impaired	
Pinal Creek Setka Ranch-Salt River AZ15060103-280D A&Ww, FBC, FC, AgL	USGS Z2.2.sw site SRPNL005.560	2000 - 1 suite	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.7	1 of 1		Low dissolved oxygen is natural due to the presence of groundwater upwelling.
	USGS Z4.sw site SRPNL005.571	1998 - 1 suite 2000 - 1 suite	Copper (dissolved)	varies with hardness (A&Ww)	<30 - 190	1 of 2		
			Manganese (total) mg/L	19600 (FBC)	150 - 57600	1 of 2		
			pH (low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	6.1 - 7.2	1 of 2		
			Zinc (dissolved)	varies with hardness (A&Ww)	<20 - 1100	1 of 2		
	USGS Z4.3 (HOFB) site SRPNL005.5.07	1999 - 1 suite 2000 - 1 suite	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	0.9 - 3.6	2 of 2		Low dissolved oxygen is natural due to the presence of groundwater upwelling.
			Manganese (total) mg/L	19600 (FBC)	44900 - 49500	2 of 2		
			pH (low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	5.8 - 6.0	2 of 2		
	USGS Z4.4 site SRPNL005.467	1999 - 3 suites 2000 - 1 suite	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	0.5 - 3.7	3 of 3		Low dissolved oxygen is natural due to the presence of groundwater upwelling.
			Manganese (total) mg/L	19600 (FBC)	44100 - 52700	3 of 3		
			pH (low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	5.9 - 6.0	3 of 3		
	USGS Z4.5 site SRPNL005.464	2000 - 1 suite	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	3.2	1 of 1		Low dissolved oxygen is natural due to the presence of groundwater upwelling.

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Manganese (total) mg/L	19600 (FBC)	57900	1 of 1		
			pH (low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	6.0	1 of 1		
	USGS Z4.7 site SRPNL005.464	1999 - 1 suite 2000 - 3 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	3.2 - 8.5	1 of 4		Low dissolved oxygen is natural due to the presence of groundwater upwelling.
			Manganese (total) mg/L	19600 (FBC)	3600 - 52100	1 of 4		
			pH (low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	6.0 - 6.9	3 of 4		
	USGS Z5.sw site SRPNL005.372	2000 - 6 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.4 - 7.2	2 of 6		Low dissolved oxygen is natural due to the presence of groundwater upwelling.
			Manganese (total) mg/L	19600 (FBC)	7100 - 57600	1 of 6		
			pH (low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	6.1 - 6.6	2 of 6		
	USGS Z5.7 site SRPNL005.228	2000 - 5 suites	Manganese (total) mg/L	19600 (FBC)	8700 - 54400	1 of 5		
	USGS Z7.sw site SRPNL005.049	2000 - 5 suites	Manganese (total) mg/L	19600 (FBC)	5000 - 45900	1 of 5		
	USGS Z9a.sw site SRPNL004.773	2000 - 6 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.5 - 8.0	1 of 6		
			Manganese (total) mg/L	19600 (FBC)	2400 - 31200	1 of 6		
	USGS JJ15.sw site Upstream of Pringle Pump Station SRPNL004.361	2000 - 4 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.6 - 7.0	1 of 4		Low dissolved oxygen is natural due to the presence of groundwater upwelling.

TABLE 19. SALT WATERSHED – DATA MONITORING – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Phelps Dodge/Pinal Creek Group WQARF Monitoring At Pringle SRPNL004.36	1998 - 1 metals, 1 pH 1999 - 12 metals, 12 pH 2000 - 12 metals, 12 pH	Beryllium (total) µg/L	0.21 (FC) 4.0 (FBC)	5.0	2 of 2 2 of 2		Beryllium: a total of 25 samples were reported. 23 of these were not counted for the assessment because the Method Detection Limit (MDL) was higher than both Beryllium standards for FC and FBC. 2 of 2 samples were combined with 2 of 2 samples from Phelps Dodge/Pinal Creek Group WQARF Monitoring site at Inspiration Dam. Data was not included in the final assessment as the Sampling and Analysis Plans and Quality Assurance Plans could not be located. Including or not including these results did not affect the final assessment.
			Copper (dissolved) µg/L	varies with hardness (A&Ww)	<10 - 100	3 of 25		
			Manganese (total)	19600	<50 - 26200	3 of 25		
	Phelps Dodge/Pinal Creek Group WQARF Monitoring At Inspiration Dam SRPNL003.30	1998 - 1 metals, 1 pH 1999 - 12 metals, 12 pH 2000 - 12 metals, 12 pH	Beryllium (total) µg/L	0.21 (FC) 4.0 (FBC)	5.0	2 of 2 2 of 2		Beryllium: a total of 25 samples were reported. 23 of these were not counted for the assessment because the Method Detection Limit (MDL) was higher than both Beryllium standards for FC and FBC. Data was not included in the final assessment as the Sampling and Analysis Plans and Quality Assurance Plans could not be located. Including or not including these results did not affect the final assessment.
			Copper (dissolved) µg/L	varies with hardness (A&Ww)	<10 - 80	3 of 25		
	USGS At Inspiration Dam near Globe SRPNL003.30 100727	1996 - 6 suites 1997 - 6 suites 1998 - 5 suites 1999 - 4 suites 2000 - 4 suites, 1 field, 4 bact	Beryllium (total) µg/L	0.21 (FC)	0.27 - 1.9	7 of 7		Beryllium: a total of 25 samples were reported. 23 of these were not counted for the assessment because the Method Detection Limit (MDL) was higher than both Beryllium standards for FC and FBC.
			Manganese (total) µg/L	19600 (FBC)	180 - 53000	9 of 27		
			Turbidity NTU	50 (A&Ww)	0.19 - 140	1 of 26		
	Reach Summary Row A&Ww Impaired FC Inconclusive FBC Impaired AgL Impaired	1996 - 2000 115 total samples 104 sampling events Missing core parameters	Beryllium (total) µg/L	0.21 (FC)	0.27 - 5.0	9 of 9	Inconclusive	USGS and the Pinal Creek Group collected a total of 120 samples at 14 sites in 1996-2000. Reach is assessed as "impaired" due to manganese and low pH. (Low pH only in the upper portion of this segment). Add to Planning List due to beryllium exceedances and missing core parameters.
			Beryllium (total) µg/L	4.0 (FBC)	0.27 - 5.0	2 of 9	Inconclusive	
			Copper (dissolved) µg/L	varies with hardness (A&Ww)	<10 - 180	1 of 120	Attaining	
			Manganese (total) µg/L	19600 (FBC)	<50 - 57900	19 of 114	Impaired	

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			pH (low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	5.8 - 7.2	12 of 120	Attaining	
						12 of 20 (upstream of site z5.7)	Impaired	
			Turbidity NTU	50 (A&Ww)	0.19 - 140	1 of 22	Attaining	
			Zinc (dissolved)	varies with hardness (A&Ww)	<20 - 1100	1 of 114	Attaining	
Pinto Creek headwater-Ripper Spring AZ15060103-018A A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Program At Simpson Dam	2001 - 2 field, copper	OK					
	ADEQ TMDL Program Above Henderson Ranch Mines SRPNT023.02 101039	2001 - 1 suite, 3 field, copper	OK					
	ADEQ TMDL Program At Henderson Ranch Mines	2001 - 3 field, copper	OK					
	ADEQ TMDL Program Below Henderson Ranch Mines SRPNT022.89 101061	2001 - 1 suite, 3 field, copper	Copper (dissolved)	varies with hardness (A&Ww)	2 - 44	1 of 4		
			Zinc (dissolved)	varies with hardness (A&Ww)	390	1 of 1		
	ADEQ TMDL Program Above Gibson Mine Tributary SRPNT021.31 101062	2001 - 1 suite, 3 field, copper	Copper (dissolved) µg/L	varies with hardness (A&Ww)	17 - 40	3 of 4		
	ADEQ TMDL Program Below Gibson Mine Tributary SRPNT021.30 101063	2001 - 1 suite	Copper (dissolved) µg/L	varies with hardness (A&Ww)	560	1 of 1		
			Copper (total) µg/L	500 (AgL)	640	1 of 1		
	ADEQ TMDL Program At Old Highway 60 SRPNT020.65 101064	2001 - 1 suite	Copper (dissolved) µg/L	varies with hardness (A&Ww)	32 - 920	4 of 4		
			Copper (total) µg/L	500 (AgL)	810	1 of 4		
	ADEQ TMDL Program Above cactus breccia	2001 - 1 field, copper	Copper (dissolved)	varies with hardness (A&Ww)	33	1 of 1		

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ TMDL Program Below cactus breccia	2001 - field, copper	Copper (dissolved)	varies with hardness (A&Ww)	47	1 of 1		
	BHP Mining NPDES permit instream monitor Above Cottonwood Gulch AMP1	1997 - 1 field, 1 metals 1999 - 2 field, 2 metals 2000 - 1 field, 1 metals	OK					
	BHP Mining NPDES permit instream monitor Above Cottonwood Gulch AMP2	1996 - 3 field, 3 metals 1999 - 2 field, 2 metals 2000 - 1 field, 1 metals	Copper (dissolved) µg/L	varies with hardness (A&Ww)	<20 - 110	1 of 6		
	BHP Mining NPDES permit instream monitor Below Cottonwood Gulch AMP3	1996 - 3 field, 3 metals 1999 - 3 field, 3 metals 2000 - 1 field, 1 metals	OK					
	BHP Mining NPDES permit instream monitor Below Miller Springs Gulch DW24	1998 - 2 field, 2 metals 1999 - 4 field, 4 metals 2000 - 3 field, 3 metals	OK					
	BHP Mining NPDES permit instream monitor Below DW24 Site PC2UP	1998 - 2 field, 2 metals 1999 - 4 field, 4 metals 2000 - 3 field, 3 metals	Beryllium µg/L	0.21 (FC)	<0.2 - 0.42	1 of 2		
	ADEQ TMDL Program At USGS Gage below Haunted Canyon SRPNT016.18 101068	2000 - 2 suites	OK					
	BHP Mining NPDES permit instream monitor Below Gold Gulch Weir & Haunted Canyon AMP4	1996 - 5 field, 6 metals 1997 - 2 field, 2 metals 1998 - 2 field, 2 metals 1999 - 4 field, 4 metals 2000 - 3 field, 3 metals	Beryllium µg/L	0.21 (FC)	<0.2 - 0.34	1 of 7		
			Turbidity NTU	50 (A&Ww)	0.64 - 56	1 of 13		
	Reach Summary Row A&Ww Not attaining FC Attaining FBC Inconclusive AgI Attaining AgL Attaining	1996 - 2001* [illegible] samples [illegible] sampling events Missing core parameters: bacteria, nutrients	Beryllium µg/L	0.21 (FC)	<0.2 - 0.42	2 of 20	Attaining	ADEQ & BHP's Consultant collected a total of [illegible] samples from [illegible] sites. Reach assessed as "not attaining" due to copper. A copper TMDL was approved by EPA in 2001. * Monitoring in 2001 was included in this assessment because 2000 was an exceptionally dry year.
			Copper (dissolved) µg/L	varies with hardness (A&Ww)	[illegible]	[illegible]	Not attaining	
			Copper (total) µg/L	500 (AgL)	[illegible]	[illegible]	Attaining	
			Turbidity NTU	50 (A&Ww)	0.64 - 56	1 of [illegible]	Attaining	

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Zinc (dissolved)	varies with hardness (A&Ww)	390	1 of 58	Attaining	
Pinto Creek Ripper Spring-Roosevelt Lake AZ15060103-018B A&Ww, FC, FBC, AgI, AgL	ADEQ Fixed Station Monitoring At Henderson Ford West of Globe SRPNT007.13 100346	1996 - 4 suites 1997 - 3 suites 1998 - 3 suites 1999 - 3 suites 2000 - 4 suites	Turbidity NTU	50 (A&Ww)	0.27 - 180	1 of 17		
	ADEQ TMDL Program At USGS Gage near Pinto Valley Weir SRPNT011.44 101070	2000 - 1 suite 2001 - 4 suites	OK					
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining AgI Attaining AgL Attaining	1996 - 2001* 22 samples 19 sampling events	Turbidity NTU	50 (A&Ww)	0.27 - 180	1 of 19	Attaining	ADEQ collected a total of 19 total samples at two sites in 1996-2000. Reach assessed as "attaining all uses." (* Monitoring in 2001 was included in this assessment because 2000 was an exceptionally dry year.)
Pinto Creek's unnamed tributary (aka Gibson Mine tributary) headwaters-Pinto Creek AZ15050103-887 A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Program Gibson Mine Tributary SRGIB000.01 101071	2001 - 1 suite, 3 field + copper	Beryllium µg/L	0.21 (FC)	0.51	1 of 1		
			Copper (total) µg/L	500 (AgL) 5000 (AgI)	2100 - 6200	4 of 4 2 of 4		
			Copper (dissolved) µg/L	varies A&ww)	2100 - 5900	4 of 4		
			pH SU	6.5-9.0 (A&Ww, FBC, AgL)	5.3 - 6.73	1 of 4		
			zinc (dissolved) µg/L	varies (A&Ww)	96	1 of 1		
	Reach Summary: A&Ww Impaired FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	2001 4 sampling events	Beryllium µg/L	0.21 (FC)	0.51	1 of 1	Inconclusive	ADEQ collected 4 samples in 2001 (2001 data included in this assessment because previous years had been so dry.) Reach was assessed as impaired due to copper. Also, added to Planning List due to beryllium, total copper pH, and zinc exceedances and lack of mercury and bacterial samples.
			Copper (total) µg/L	500 (AgL)	2100 - 6200	4 of 4	Inconclusive	
			Copper (total) µg/L	5000 (AgI)	2100 - 6200	2 of 4	Inconclusive	
			Copper (dissolved) µg/L	varies A&ww)	2100 - 5900	4 of 4	Impaired	
			pH SU	6.5-9.0 (A&Ww, FBC, AgL)	5.3 - 6.73	1 of 4	Inconclusive	

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			zinc (dissolved) µg/L	varies (A&Ww)	96	1 of 1	Inconclusive	
Reservation Creek headwaters-Black River AZ15060101-010 A&Wc, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Above Black River SRRES000.30 100629	1998 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Reynolds Creek headwaters-Salome Creek AZ15060103-202 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Below McFadden Creek SRREY000.70 100630	1996 - 1 suite	OK					
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Salome Creek headwaters-Roosevelt Lake AZ15060103-022 A&Wc, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Below Little Turkey Creek SRSAL014.92 100636	1996 - 1 suite	OK					
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Salt River Pinal Creek-Roosevelt Lake AZ15060103-004 A&Ww, FC, FBC, AgI, AgL	USGS Station #09498500 Above Roosevelt Lake SRSLR055.32 100745	1996 - 11 field 1997 - 13 field 1998 - 11 suites 1999 - 4 suites 2000 - 8 suites, 4 bact	Beryllium µg/L	0.21 (FC)	<0.1 - 0.6	1 of 13		
			Nitrogen (total) mg/L	2.0 (A&Ww)	0.16 - 2.1	1 of 47		
			Turbidity NTU	50 (A&Ww)	0.57 - 220	1 of 13		
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining AgI Attaining AgL Attaining	1996 - 2000 47 sampling events	Beryllium µg/L	0.21 (FC)	<0.1 - 0.6	1 of 13	Attaining	USGS collected 47 samples in 1996-2000. Reach assessed as "attaining all uses."
			Nitrogen (total) mg/L	2.0 (A&Ww)	0.16 - 2.1	1 of 47	Attaining	
			Turbidity NTU	50 (A&Ww)	0.57 - 220	1 of 13	Attaining	

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Salt River Saguaro Lake-Verde River AZ15060106A-003 A&Wc, FC, FBC, DWS, AgI, AgL	AGFD Below Stewart Mountain Dam SRSLR027.30	1999 - 2 field, 2 nutrient 2000 - 1 field, 1 nutrient	OK					
	SRP Below Stewart Mountain Dam WSRVSL2 SRSLR030.22	1996 - 12 suites 1997 - 12 suites 1998 - 11 suites 1999 - 12 suites 2000 - 14 suites, 9 pesticides	Copper (dissolved) µg/L	varies with hardness (A&Ww)	11 - 110	1 of 61		
	USGS Station #09502000 Below Stewart Mountain Dam SRSLR033.55	1999 - 2 suites, 2 bact 2000 - 6 suites, 6 bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4.1 - 9.4	2 of 8		
	Reach Summary Row A&Wc Attaining FC Attaining FBC Attaining DWS Attaining AgI Attaining AgL Attaining	1996 - 2000 72 sampling events	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4.1 - 10.3	2 of 11	Attaining	AGFD collected 3 samples in 1999-2000. SRP collected 61 samples in 1996-2000. USGS collected 8 samples in 1999-2000. Reach assessed as "attaining all uses."
			Copper (dissolved) µg/L	varies with hardness (A&Ww)	11 - 110	1 of 61	Attaining	
Snake Creek headwaters-Black River AZ15060101-045 A&Wc, FC, FBC, DWS, AgI, AgL	ADEQ Biocriteria Program Near Bear Wallow Wilderness SRSNK001.19 100643	1998 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Spring Creek headwaters-Tonto Creek AZ15060105-010 A&Wc, FC, FBC, AgL	ADEQ Fixed Station Monitoring SRSPI006.79 100380	1996 - 6 suites	OK					Only 2 bacterial samples
	Reach Summary Row A&Wc Attaining FC Attaining FBC Inconclusive AgL Attaining	1996 6 sampling events Missing core parameter (bacteria)	OK				Attaining	ADEQ collected 6 samples in 1996. Reach assessed as "attaining some uses." Could not assess Full Body Contact due to insufficient bacteria samples.
Stinky Creek headwaters-W.Fk. Black River AZ15060101-352 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Below Forest Road 116 SRSTI001.76 100652	1998 - 1 suite	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.54	1 of 1		Naturally occurring low dissolved oxygen due to ground water upwelling and low flow. Not included in the final assessment.
	Reach Summary Row	1998 1 sampling event					Not assessed	Insufficient data to assess.

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Tonto Creek headwaters-Haigler Creek AZ15060105-013 A&Wc, FC, FBC, AgI, AgL	ADEQ Intensive survey At Headwater Spring Above AGFD Fish Hatchery SRTON043.98 100350	1999 - 1 nutrient	OK					
	ADEQ TMDL Program At Headwater Spring Above AGFD Fish Hatchery SRTON073.00 101016	2000 - 3 suites, bact	OK					
	ADEQ Intensive survey Below AGFD Fish Hatchery SRTON043.52 100351	1999 - 1 nutrient	OK					
	ADEQ TMDL Program Below AGFD Fish Hatchery SRTON72.66 101017	2000 - 3 suites, bact	OK					
	ADEQ TMDL Program Above Baptist Camp and Dick Williams Creek SRTON71.72 101018	2000 - 3 suites, bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.75 - 8.8	1 of 3		Naturally occurring low dissolved oxygen due to ground water upwelling. Not included in the final assessment.
	ADEQ TMDL Program Below Baptist Camp road bridge SRTON70.86 101019	2000 - 3 suites, bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.7 - 9.1	1 of 3		Naturally occurring low dissolved oxygen due to ground water upwelling. Not included in the final assessment.
	ADEQ TMDL Program Above Horton Creek confluence SRTON69.87 101020	2000 - 3 suites, 3 bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.4 - 17.1	1 of 3		Naturally occurring low dissolved oxygen due to ground water upwelling. Not included in the final assessment.
			Escherichia coli CFU/100ml	580 (FBC)	12 - 658.6	1 of 3		
	ADEQ TMDL Program Below Horton Creek confluence SRTON69.80 101021	2000 - 2 suites, 2 bact	OK					
	ADEQ TMDL Program Above Kohls Ranch & Highway 260, USGS Gage site SRTON68.95 101022	2000 - 3 suites, 3 bact	Turbidity NTU	10 (A&Wc)	3.42 - 19.8	1 of 3		

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ TMDL Program Below Kohls Ranch Above Tontozona SRTON68.00 101023	2000 - 3 suites, 3 bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.0 - 10.0	1 of 3		
			Turbidity NTU	10 (A&Wc)	5.69 - 28.5	2 of 3		
	ADEQ Intensive Survey Above Christopher Creek SRTON038.98 100359	1996 - 1 suite, 1 bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.29 - 7.06	1 of 1		
			Turbidity NTU	10 (A&Wc)	19.5 - 22.7	1 of 1		
	ADEQ TMDL Program Above Christopher Creek SRTON66.90 101024	2000 - 3 suites, 3 bact	Turbidity NTU	10 (A&Wc)	8.81 - 54.5	3 of 3		
	ADEQ Intensive Survey Below Christopher Creek SRTON038.81 100360	1996 - 1 suite, 1 bact 2000 - 6 suites, 5 bact	Beryllium µg/L	0.21 (FC)	0.89	1 of 1		4 other beryllium samples were not used because the Method Detection Limit was too high to assess Fish Consumption.
			Turbidity NTU	10 (A&Wc)	1.36 - 78.4	3 of 6		
	ADEQ Intensive Survey Above Bear Flats south of Kohls Ranch SRTON038.32 100357	1996 - 3 suites, 2 bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.48 - 9.7	1 of 3		Sampled on 5 consecutive days with monsoon rains. These 4 consecutive samples were counted as one sampling event.
			Escherichia coli CFU/100ml	580 (FBC)	8 - 1400	1 of 2		
			Turbidity NTU	10 (A&Wc)	3.34 - 261	1 of 2		
	ADEQ TMDL Program Above Bear Flats Residence area, below Christopher Creek SRTON65.38 101025	2000 - 3 suites, 3 bact	Turbidity NTU	10 (A&Wc)	21.8 - 98	3 of 3		
	ADEQ TMDL Program Below Bear Flats Residence area access road SRTON64.22 101026	2000 - 3 suites, 3 bact	Turbidity NTU	10 (A&Wc)	28.43 - 101.4	3 of 3		
	ADEQ Fixed Station Monitoring Below Bear Flats south of Kohls Ranch SRTON037.17 100358	1996 - 1 suite	OK					

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row A&Wc Impaired FC Inconclusive FBC Attaining AgI Attaining AgL Attaining	1999 - 2000 44 samples 11 sampling events	Beryllium µg/L	0.21 (FC)	0.89	1 of 1	Inconclusive	ADEQ collected a total of 44 samples from 17 sites. Reach assessed as "Impaired" due to turbidity. Add to Planning List due to beryllium exceedance.
			Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.0 - 17.1	3 of 44	Attaining	
			Escherichia coli CFU/100ml	580 (FBC)	8 - 1400	2 of 41	Attaining	
			Turbidity NTU	10 (A&Wc)	1.36 - 281	23 of 43	Impaired	
Tonto Creek Haigler Creek-Spring Creek AZ15060105-011 A&Wc, FC, FBC, AgI, AgL	ADEQ Biocriteria Program At Hellsgate, below Haigler Cr. SRTON032.31 100669	1997 - 1 suite	OK					
	Reach Summary Row	1997 1 sampling event	OK				Not assessed	Insufficient data to assess.
Tonto Creek Rye Creek-Gun Creek AZ15060105-008 A&Wc, FC, FBC, AgI, AgL	ADEQ Fixed Station Monitoring Above USGS gage @ Jakes Corner SRTON015.88 100349	1996 - 5 suites 1997 - 4 suites 1998 - 4 suites 1999 - 3 suites 2000 - 4 suites	Turbidity NTU	10 (A&Wc)	0.5 - 36.2	7 of 20		
	Reach Summary Row A&Wc Impaired FC Attaining FBC Attaining AgI Attaining AgL Attaining	1996 - 2000 20 sampling events	Turbidity NTU	10 (A&Wc)	0.5 - 36.2	7 of 20	Impaired	ADEQ collected 20 samples in 1996-2000. Reach of Tonto Creek was assessed as impaired due to turbidity.
Workman Creek, headwaters-Salome Creek AZ15060103-195 A&Wc, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Below Workman Creek Falls SRWRK005.34 100696	1996 - 1 suite	OK					
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
LAKE MONITORING DATA								
Apache Lake AZL15060106A-0070 A&Wc, FC, FBC, DWS, AgI, AgL	AGFD Routine Monitoring 3 sites combined SRAPA	1999- 2 field, 2 NH3, 2 nutrient	OK					Missing most core parameters
	ADEQ Clean Lakes Program SRAPA 100006	1996 - 1 suite	OK					Missing core parameters: bacteria
	Reach Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive AgI Inconclusive AgL Inconclusive	1996 - 1999 3 sampling events Missing core parameters	OK				Inconclusive	ADEQ and AGFD collected a total of 3 samples in 1996-1999. Lake assessed as "inconclusive" due to a lack of core parameters.
Big Lake AZL15060101-0160 A&Wc, FC, FBC, DWS, AgI, AgL	AGFD Routine Monitoring SRBIG	1996 - 2 field, 2 NH3, 2 nutrient 1997 - 1 field, 1 NH3, 1 nutrient	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.4 - 8.3	1 of 3		Missing most core parameters.
	Reach Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive AgI Inconclusive AgL Inconclusive	1996 - 1997 3 sampling events Missing core parameters	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.4 - 8.3	1 of 3	Inconclusive	AGFD collected 3 samples in 1996-1996. Lake assessed as "inconclusive" due to missing core parameters.
Canyon Lake AZL15060106A-0250 A&Wc, FC, FBC, AgI, AgL	AGFD Routine Monitoring 3 sites combined SRCAN	1998 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Crescent Lake AZL15060101-0420 A&Wc, FC, FBC, AgI, AgL	AGFD Routine Monitoring SRCRE	1996 - 3 field, 3 NH3, 3 nutrients 1997 - 1 suite 1998 - 2 suites 1999 - 1 suite	pH (high) SU	6.5 - 9.0 (A&Wc, FBC, AgI, AgL)	7.97 - 10.1	5 of 7		Missing core parameters: turbidity, flow, dissolved metals, boron, bacteria, arsenic, beryllium, copper, lead, mercury.
	ADEQ Lakes Program SRCRE-B 100993	1999 - 1 suite	pH (high) SU	6.5 - 9.0 (A&Wc, FBC, AgI, AgL)	9.64 - 9.83	1 of 1		Missing core parameters: bacteria, total manganese and beryllium
			Nitrogen (total) mg/L	2	2.05	1 of 1		
	Reach Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	1996 - 1999 8 sampling events Missing core parameters	pH (high) SU	6.5 - 9.0 (A&Wc, FBC, AgI, AgL)	7.97 - 10.1	6 of 8	Inconclusive	ADEQ & AGFD collected a total of 8 samples from 2 sites in 1996-1999. Lake assessed as "inconclusive" and should be added to the Planning List due to pH and nitrogen exceedances and missing core parameters.
			Nitrogen (total) mg/L	2	2.05	1 of 1	Inconclusive	

TABLE 19. SALT WATERSHED – DATA MONITORING – 2002 ASSESSMENT								
STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Roosevelt Lake AZL15060103-1240 A&Ww, FC, FBC, DWS, AgI, AgL	AGFD Routine Monitoring Dam Site SRROO	2000 - 8 suites	OK					Missing core parameters: turbidity, bacteria, fluoride, barium, beryllium, dissolved metals, boron, lead. Mercury Method Detection Limit is not low enough to assess Fish Consumption. (8 sampling events)
	AGFD Routine Monitoring Salt Arm Site SRROO	2000 - 7 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.6 - 13.15	1 of 7		
	AGFD Routine Monitoring Tonto Arm Site SRROO	2000 - 8 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.32 - 9.64	1 of 8		
	AGFD Routine Monitoring Windy Hill Site SRROO	2000 - 3 suites	OK					
	ADEQ Clean Lakes ProgramSRROO-A 100075	1996 - 1 suite 2000 - 1 suite	OK					Missing core parameters: bacteria, boron, beryllium (Only 2 sampling events)
	ADEQ Clean Lakes ProgramSRROO-B 100076	1996 - 1 suite 2000 - 1 suite	OK					
	ADEQ Clean Lakes ProgramSRROO-C 100077	1996 - 1 suite 2000 - 1 suite	OK					
	ADEQ Clean Lakes ProgramSRROO-D 100078	1996 - 1 suite	OK					
	ADEQ Clean Lakes Program SRROO-E 100079	1996 - 1 suite	OK					
	Reach Summary Row [illegible] A&Ww Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive AgI Inconclusive AgL Inconclusive	1996 - 2000 [illegible] 34 samples 10 sampling events Missing core parameters	Dissolved oxygen [illegible] mg/L	6.0 (90% saturation) (A&Ww)	5.32 - 13.15	2 of 33	Inconclusive	ADEQ & AGFD collected a total of 34 samples at [illegible] sites in 1996 & 2000. Lake assessed as "Inconclusive" due to missing core parameters.
Saguaro Lake AZL15060106A-1290 A&Wc, FC, FBC, DWS, AgI, AgL	ADEQ Lakes Program SRSAG-BJ 100081	1999 - 1 suite	Dissolved Oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.07 - 6.11	1 of 1		Low dissolved oxygen attributed to natural lake turnover of the water column in October, a seasonal condition. Not used in the final assessment.
	ADEQ Lakes Program SRSAG-A 100082	1996 - 1 suite 1999 - 1 suite 2000 - 1 suite	Dissolved Oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.63 - 10.49	1 of 3		Low dissolved oxygen attributed to natural lake turnover of the water column in October, a seasonal condition. Not used in the final assessment.
	ADEQ Fixed Station Monitoring Lakes Program At Marina SRSAG-MAR1 100994	2000 - 1 VOCs	OK					Missing core parameters: bacteria
	ADEQ Lakes Program SRSAG-MAR2 100995	1999 - 1 field 2000 - 1 VOCs, 1 inorganics						

TABLE 19. SALT WATERSHED – DATA MONITORING – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Lakes Program SRSAG-BAG 101001	1999 - 1 suite						
	AGFD Routine Monitoring Above Bagley Flats SRSAG	1999 - 6 field, 6 NH3, 6 nutrients 2000 - 2 field, 2 NH3, 2 nutrients	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.1 - 9.85	1 of 8		Low dissolved oxygen attributed to natural lake turnover of the water column in October, a seasonal condition. Not used in the final assessment.
	AGFD Routine Monitoring Peregrine Cove SRSAG	1999 - 6 field, 6 NH3, 6 nutrients 2000 - 2 field, 2 NH3, 2 nutrients	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.2 - 10.02	1 of 8		Low dissolved oxygen attributed to natural lake turnover of the water column in October, a seasonal condition. Not used in the final assessment.
	AGFD Routine Monitoring Dam site SRSAG	1999 - 5 field, 5 NH3, 5 nutrients 2000 - 2 field, 2 NH3, 2 nutrients	OK					Missing core parameters: turbidity, metals, bacteria, boron, fluoride, barium
	Reach Summary Row A&Wc: Attaining FC: Attaining FBC: Inconclusive DWS: Attaining Agl: Attaining Agl: Attaining	1998 - 2000 29 sampling events Missing core parameters	OK				Attaining	ADEQ & AGFD collected a total of 29 samples from 8 sites in 1998-2000. Lake assessed as "attaining some uses." Add to Planning List due to missing bacteria samples.

Information for Interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from using AZ (for streams) or AZL (for lakes) + Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses", "Agency", and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" -- This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" -- The year and number of water samples is shown. The federal "water year is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
  - "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among samples as many different programs and agencies provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
  - "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
  - If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters
- "Standards Exceeded at this Site per Sampling Event."
  - Although many parameters may be analyzed, only those exceeding a standard are shown.
  - "OK" indicates that no standards were exceeded.
  - The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
  - "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
  - A mean or geometric mean will be shown along with the range of results if applicable to the standard.
- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or " Inconclusive." See assessment criteria in Chapter III of Volume I.

Ground Water Assessments in the Salt Watershed

Major Ground Water Stressors -- Monitoring data collected from wells in this watershed between October 1995-October 2000 are summarized in **Table 20** and illustrated in **Figure 36, 37, and 38.**

As **Table 20** indicates, only 17 wells were sampled. Among these wells, the only constituents with standards analyzed were fluoride, metals, and nitrates. This is not enough water quality information to base a groundwater assessment; however, it should be noted that among those samples, no standards were exceeded.

TDS concentrations – Water quality can be characterized based on concentration of Total Dissolved Solids (TDS). No TDS water quality standards apply in this watershed; however, elevated salinity limits the practical uses of ground water as TDS over 500 mg/L has an off-flavor, and TDS over 1000 mg/L will limit its use for some crops. In this watershed, TDS was monitored only in two wells **(Figure 37)**. This is not enough samples to characterize water quality.

Nitrate concentrations – Water quality can also be characterized by looking at the concentration of nitrate in ground water **(Figure 38)**. Naturally occurring nitrate concentrations in ground water are generally below 3 mg/L. Concentrations above 5 mg/L indicate potential anthropogenic sources of nitrate. Of the 17 wells monitored for nitrate, two exceeded this 5 mg/L concentration (12% of the wells). Exceedances may be related to historic irrigated agriculture or septic systems.

When nitrate concentrations exceed 10 mg/L, Arizona's Aquifer Water Quality Standard has been exceeded. This standard was set to protect human health ,as water with nitrate greater than 10 mg/L may present a health problem for babies and should not be consumed by nursing mothers. None of the 17 wells monitored exceeded 10 mg/L. However, efforts should be taken to minimize further contamination of ground water by nitrate.

Table 20. Salt Watershed Ground Water Monitoring 1996 - 2000

MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	0		--	--
	Fluoride	0		--	--
	Metals/Metaloids	0		--	--
	Nitrate	0		--	--
	VOCs + SVOCs*	0	--	--	--
	Pesticides	0	--	--	--
TARGETED MONITORING WELLS	Radiochemicals	0		--	--
	Fluoride	17		0	0%
	Metals/metaloids	17		0	0%
	Nitrate	17		0	0%
	VOCs + SVOCs*	0	--	--	--
	Pesticides	0	--	--	--

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells (all targeted wells)	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
2	2	0	0	0

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells (all targeted wells)	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
17	15	2	0

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.

*The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.

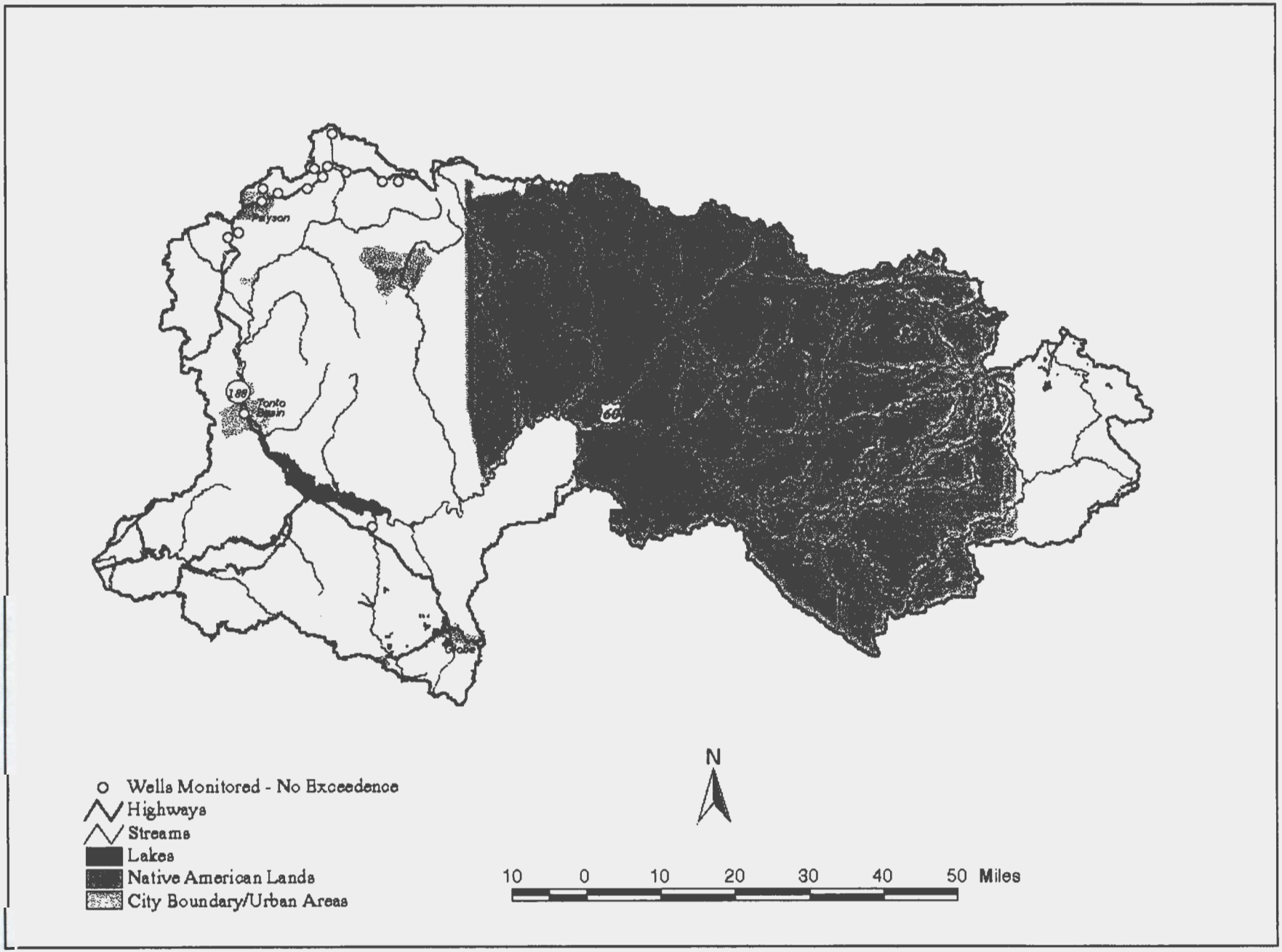

Figure 36. Ground Water Monitoring in the Salt Watershed – 1995-2000

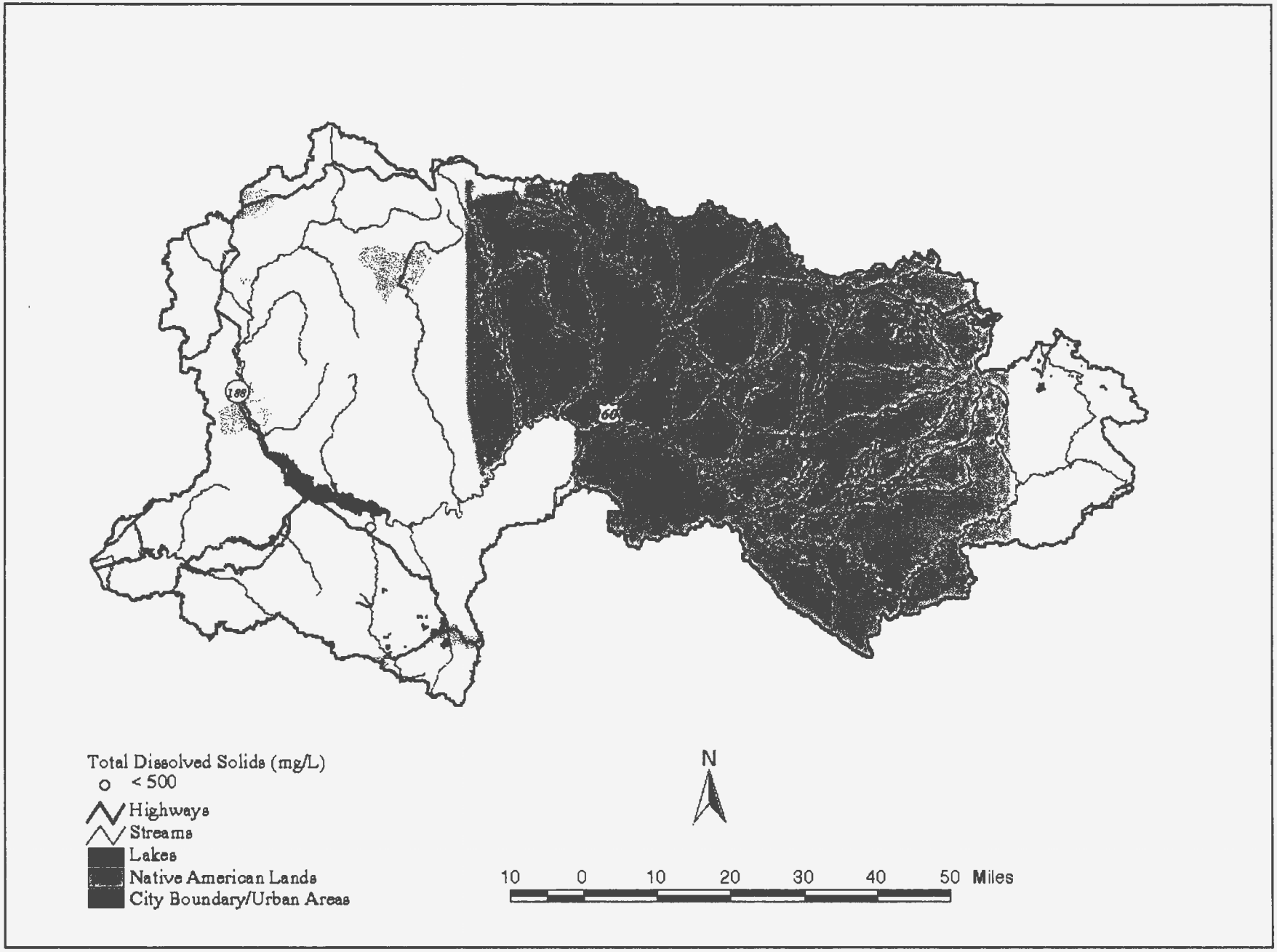

Figure 37. Classification of Ground Water Quality by TDS Concentration in the Salt Watershed

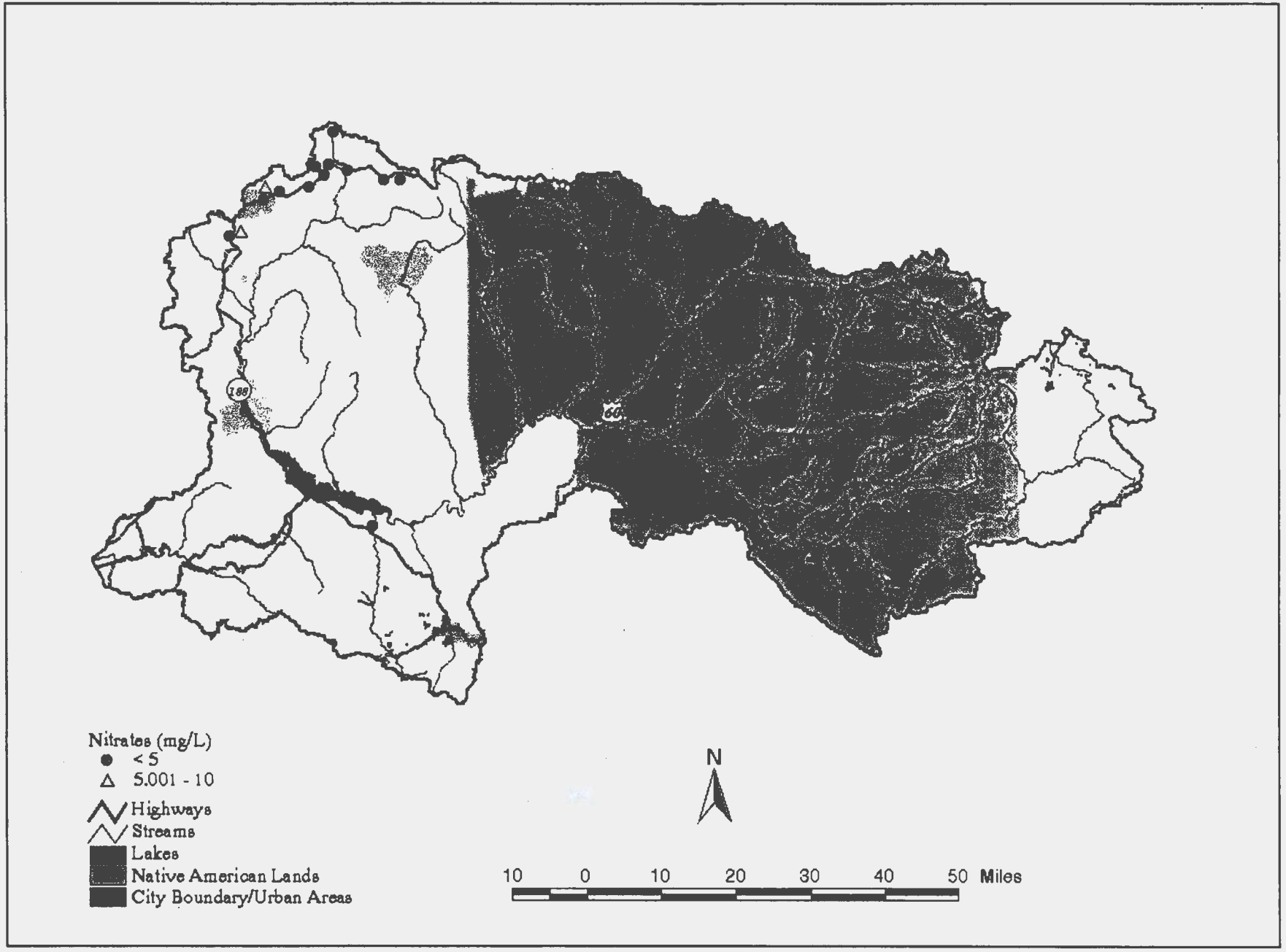

Figure 38. Classification of Ground Water by Nitrate Concentration in the Salt Watershed

Watershed Studies and Alternative Solutions in the Salt Watershed

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the Salt Watershed. Watershed partnerships active in this watershed are also described.

Surface Water Studies and Mitigation Projects

Total Maximum Daily Load Analyses – The following TMDL analyses have been completed or are ongoing in this watershed. Further information about the status of these investigations can be obtained by contacting the TMDL Program manager at (602) 207-4468, or at ADEQ's web site: http://www.adeq.state.az.us/environ/water/assess.

- The Pinto Creek Phase I Copper TMDL -- This TMDL was completed and approved by EPA in April 2001. ADEQ is currently involved in the sampling and analysis for a Phase II TMDL on this stream. This TMDL was established to define goals for the watershed necessary to achieve water quality criteria for dissolved copper. This water quality criterion varies with hardness in the water; the dissolved copper standard being more stringent with less water hardness.

  The entire Pinto Creek, from its headwaters to Roosevelt Lake, was originally included on the 303(d) list as impaired by copper. Current monitoring and analysis indicates that Pinto Creek below the Pinto Valley Weir (or below Ripper Springs Creek) consistently meets all surface water standards and should be delisted.

  Loading capacities were calculated for five stream flow events at nine target sites (locations), resulting in 45 different Total Maximum Daily Loads. At lowest flows (down to 0 cubic feet per second flow), the allocations are articulated on a concentration basis (mg/L) rather than a mass loading basis (mg/day). These concentration allocations are based on the standard that varies by water hardness.

  A waste load allocation was established for the BHP Pinto Valley Mine outfall 005 and nonpoint source loading allocations were established for potential sources that contribute drainage to Pinto Creek at Miller Spring Gulch, Gold Gulch, and North and South Ripper Spring canyons. These allocations were calculated based on the assumption that the proposed Carlotta Copper Mine will be developed along Pinto Creek. This assumption affected the allocations in two ways:

  - Stream discharge values assumed proposed facilities were in place, and
  - The Cactus Breccia Formation would no longer be a source of dissolved copper to Pinto Creek (due to mining and the Pinto Creek diversion).

  Water quality management and remediation goals were set by this Phase I TMDL. EPA recognized that abandoned mines present significant technical, legal, and monetary challenges to designing and implementing remedial measures. Given the copper levels within Pinto Creek, and the potential to control one significant source of contamination (Gibson Mine, an abandoned mine), EPA believes that it is technically feasible to meet the proposed loading allocations.

  To support the Pinto Creek Phase II Copper TMDL, ADEQ is collecting water quality data at 24 locations, monitoring continuous stream flow, and collecting precipitation data over a 12 to 18 month period. This data will be used to construct, calibrate and validate a dynamic point and non-point source model of the Pinto Creek watershed. The sample plan will attempt to further identify and quantify the source of copper from natural and from anthropogenic point and non-point sources, as well as monitor the effectiveness of any mitigation efforts implemented at the Gibson Mine.

- Tonto Creek TMDL Study – In 2000, ADEQ initiated monitoring to support phosphorus, nitrogen, and *Escherichia coli* TMDLs in a segment of Tonto Creek, from its headwaters to the Bear Flats residence area below Christopher Creek. Up to six nutrients, bacteria, and turbidity samples were collected at eleven sampling sites in 2000 to determine the extent of contamination and contribution from possible sources. Potential sources identified included: wildlife, recreation, septic tanks, and state fish hatchery.

Monitoring indicates that *Escherichia coli* should be delisted, as only two out of 41 samples exceeded this standard. ADEQ is also proposing delisting the nutrients as no single sample maximum nutrient standards were exceeded. More data is currently being collected to verify that the annual mean standard for nitrogen or phosphorus will not be exceeded.

Repeated exceedances of the turbidity standard during this monitoring indicates that turbidity is impairing Aquatic and Wildlife uses on this stream; therefore, this stressor should be added to the 303(d) List.

- Christopher Creek TMDL Study – ADEQ also initiated a TMDL for nitrogen on Christopher Creek in 2000. The study area included all of Christopher Creek, from its headwaters to its confluence with Tonto Creek. Eight sites were sampled up to six times in 2000 to determine the extent of contamination and contribution from possible sources of excess nitrogen. The potential sources of nitrogen were identified as: wildlife, recreation, and septic tanks.

  The single sample maximum phosphorus and nitrogen standards were not exceeded in 39 samples. Currently, ADEQ is collecting additional samples to verify that the annual mean nutrient standards are not being exceeded. Based on this investigation, ADEQ is proposing to delist nutrients as on Christopher Creek from the 303(d) List.

  Sampling did indicate that turbidity is impairing Aquatic and Wildlife uses on this stream; therefore, this stressor should be added to the 303(d) List.

BHP NPDES Permit Monitoring in Pinto Creek -- The BHP Pinto Valley Operations mine discharges into Pinto Creek. AMEC Earth and Environmental, Inc., a consultant for BHP, sampled six locations to fulfill requirement of the NPDES permit for the mine.

These samples were used in this assessment except for the data collected following a spill event (October 22, 1997 - July 31, 1998), as the cleanup of all contaminants from this spill has subsequently been completed.

Water Quality Improvement Grants – ADEQ awarded the following Water Quality Improvement Grants in this watershed.

- Lower Salt River Pollution Prevention Education and Outreach Project – The Tonto National Forest, Mesa Ranger District was funded in 2001 to install three restroom facilities along the Salt River below Saguaro Lake, conduct public education and outreach, and obtain bacterial water quality samples for two years. The project is to improve river water quality, by reducing bacteria levels due to intense recreational usage. The river has not been listed for impairments due to bacteria levels; however, previously restroom facilities were not available along a significant portion of this heavily used river.

  This grant project is ongoing, with the first bacterial samples being collected in July of 2001through September 2001. The second round of sampling will occur in the summer of 2002. For more information about the project, contact the Tonto National Forest, Mesa Ranger District at (480) 610-3312.

Water Protection Fund Projects – The following projects received Water Protection Funds from the Arizona Department of Water Resources:

- Lofer Cienega Restoration Project – The White Mountain Apache Tribe was funded to restore the large Lofer Cienega. This project incorporates stream assessments, long-term monitoring, fence construction, grazing management, biological assessments, and feral horse trapping and removal in an attempt to restore Lofer Cienega. When restored, this cienega should provide critical wildlife and fish habitat. In addition, it is a significant cultural resource to the tribe.

- Gooseberry "Watershed" Restoration Project – The White Mountain Apache Tribe was also awarded funds in 1999 to restore the Gooseberry drainage area by improving management of the riparian meadows and reconstructing stream crossings. The project incorporated stream assessments, improved riparian grazing management, cleanup projects and public education, channel restoration and biologic assessments to meet its goals.

- Cherry Creek Enhancement Demonstration Project – The Tonto National Forest received Watershed Protection Funds to restore one degraded mile of Cherry Creek. The Forest Service is to assess the project site, including a topographic survey and evaluation of the site's characteristics and hydrology. The dimension, pattern, and profile of a

selected reference channel will be used to guide the design of the restoration channel reconfiguration.

- Dakini Valley Riparian project along Gordon Creek -- Dakini Valley LLC received funds to protect approximately one-half mile of Gordon Creek from overgrazing by constructing a two-mile long elk fence around the area. Cat claw, that has invaded two acres of Gordon Creek terrace, is to be cut down, the area reseeded with native grasses, and emory oak trees are to be planted along the stream bank. Two dirt tanks at Bear Flat are also to be repaired to provide off-channel water for cattle and elk. Informational signs and literature describing the project resource issues and goals are to be provided for visitors and guests at Dakini Valley.

- Picacho Reservoir Riparian Enhancement Project – Pinal County received funds to purchase sufficient CAP water over a 15-20 year period to protect and enhance the 2,400-acre riparian and wetland habitat that exists within the Pichacho Reservoir. Under this grant, a minimum pool within the reservoir can be maintained as this wildlife and aquatic habitat has been periodically threatened by lack of water or dry-out from irrigation drawdown and drought.

Ground Water Studies and Mitigation Projects

Federal and State Superfund Cleanup Sites -- One Superfund site and one Department of Defense cleanup site are located in this watershed.

- Pinal Creek WQARF Superfund Site – The Pinal Creek WQARF Superfund cleanup site is located in the Globe-Miami area and includes the ephemeral and perennial reaches of Pinal Creek, Miami Wash, Bloody Tanks Wash and Russell Gulch. The site also encompasses the Phelps Dodge Miami Mine (formerly Cyprus Miami Mining Corp.) and the BHP Billiton Miami Mine (formerly BHP Copper and Magma Copper), Copper Cities Mine, Old Dominion Mine, and the Solitude Tailings.

  Ground water contamination at the site is dominated by an acid-metal plume and a neutralized plume. Additionally, high levels of manganese exist in the perennial reach of Pinal Creek.

  This site was established in 1990, and a consent decree governing remaining clean up was signed in 1997. The Pinal Creek Group (a consortium of mining operations in the area including Phelps Dodge, BHP Copper Company, and Inspiration Consolidated Copper Company) have taken the following remedial actions to confine the extent of contamination and prevent surfacing of contamination and further degradation of Pinal Creek.

  - From 1990 to 1998 contaminated ground water was pumped from four well fields along the alluvial aquifer.
  - In 1998, ground water from the leading edge of the plume was pumped, treated, and discharged to Pinal Creek.
  - During 2000-2001, a subsurface barrier wall was constructed in lower Pinal Creek to capture and contain the entire plume for treatment. Also, a second treatment plant and a second containment system were constructed to capture and treat contaminated ground water from the upstream portions of the plume in Kiser Basin.

  Members of the Pinal Creek Group are conducting source control activities at the individual mine sites, including ground water extraction, facility upgrades, capping and revegetation of mine waste piles, runoff controls and other remedial actions.

- Waterdog Recreational Annex Cleanup Site -- The Waterdog Recreation Area is a Department of Defense cleanup site located on the eastern shore of Apache Lake. This recreation area was originally an annex to Williams Air Force Base, constructed to provide access to Apache Lake for military and civilian air force personnel.

  An inspection in 1991 of the three underground storage tanks used to fuel the boats revealed petroleum hydrocarbons were contaminating ground water and soils, and resulted in the removal of the storage tanks. Further remediation of the soils using a bioventing system began in 1995. Ground water samples from monitor wells in 1999 indicated petroleum contamination above the Arizona Aquifer Water Quality Standards. Quarterly ground water sampling will continue until the petroleum contamination is reduced to levels below these standards. The petroleum contamination is expected to be reduced due to both natural attenuation and on-going remediation activities.

Watershed Partnerships

The Lower Verde-Lower Salt Watershed Advisory Group – This advisory group, formed 1999, is comprised of private citizens, U.S. Forest Service, ADEQ, Arizona Department of Water Resources, and Salt River Project. Key issues this group has focused on include:

- litter on lakes and rivers,
- potential for MTBE contamination in lakes,
- land use,
- traffic control,
- public education and outreach regarding environmental issues, and
- enforcement of existing environmental laws and regulations.

For information about meetings contact either Dan Jones, at the Maricopa County Sheriffs Office D_Jones@mcso.maricopa.gov and Lynda Bearult with Salt River Tubing Lynda@Saltrivertubing.com.

San Pedro-Willcox Playa-Rio Yaqui Watershed

SAN PEDRO-WILLCOX PLAYA-RIO YAQUI WATERSHED CHARACTERISTICS

SIZE	7,015 square miles (6% of the State's land area).
POPULATION BASE	Approximately 130,000 people live in this watershed (estimated from the 2000 census). This is about 2.5% of the state's population
LAND OWNERSHIP (Figure 39)	Private land 38% — Bureau of Land Management 5% — Military land 4% State Land Dept. 38% — U.S. Forest Service 14% — Other state and federal 1%
LAND USES AND PERMITS (Figure 40)	Communities in this watershed include rapidly growing Sierra Vista and historic landmarks such as Tombstone, Douglas, and Bisbee . Grazing is widespread in this watershed, with significant areas with irrigated agriculture along the eastern side. Historic copper, silver, and gold mining occurred across the watershed; however, there are only a few active mines and mining activity reflects current market values. The San Pedro Riparian National Conservation Area managed by the Bureau of Land Management was the nation's first such area. It received this designation in 1988 to protect a 56,000 acre area along the upper San Pedro River.
HYDROLOGY AND GEOLOGY	Three hydrologically distinct surface water basins occur within this watershed: 1) The San Pedro River flows north from Mexico almost 100 miles to the Gila River, and contains many riparian areas that support rich wildlife populations; 2) The Willcox Playa is a terminal basin, so that all surface water drainage within this basin is ultimately collected in the playa; and 3) The Rio Yaqui basin contains Whitewater Draw and Black Draw with both drainages flowing south into Mexico. Flow on the San Pedro River at Charleston varies between 0.22 cfs (in 1990) to 98,000 (in 1926) (USGS 1996). Ground water pumping has limited the perennial flow of the San Pedro River flows to approximately 25 miles near the Mexican border (Brown et al. 1978). Diverse vegetation ranges from desert grassland at low elevations (4,000 feet above sea level) to alpine forest in the Pinaleno Mountains, which rise to 10,700 feet above sea level at Mount Graham. The geology is characterized by mountain ranges that trend to the northwest, separated by broad alluvial valleys and three kinds of aquifers. This is typical of the Basin and Range Hydrologic Province that this watershed is included within. Several ground water basins occur in this watershed, including: Aravaipa Canyon, Douglas, San Bernadino Valley, Upper San Pedro, Willcox Playa, most of the Lower San Pedro, and a small portion of Cienega Creek. The consolidated bedrock of the mountains that divide the ground water basins has small localized aquifers (created by fault zones). They provide only enough water for low-use domestic and stock wells. The main ground water source is provided by alluvial basin-fill sediments. Wells in these aquifers can produce more than 2,000 gallons per minute. Also, streambed alluvial aquifers produce well yields up to 1,800 gallons per minute (ADWR 1994).
UNIQUE WATERS	Aravaipa Canyon Creek and Buehman Canyon Creek (as of 2001)
ECOREGIONS	Southern Deserts, except the northern edge that is in the Southern Basin and Range.
OTHER STATES, NATIONS, OR TRIBES	This watershed primarily receives drainage from Mexico on the south and New Mexico on the east. However, the drainage from Whitewater Draw and Black Draw flows into Mexico. No tribal lands occur in this watershed.

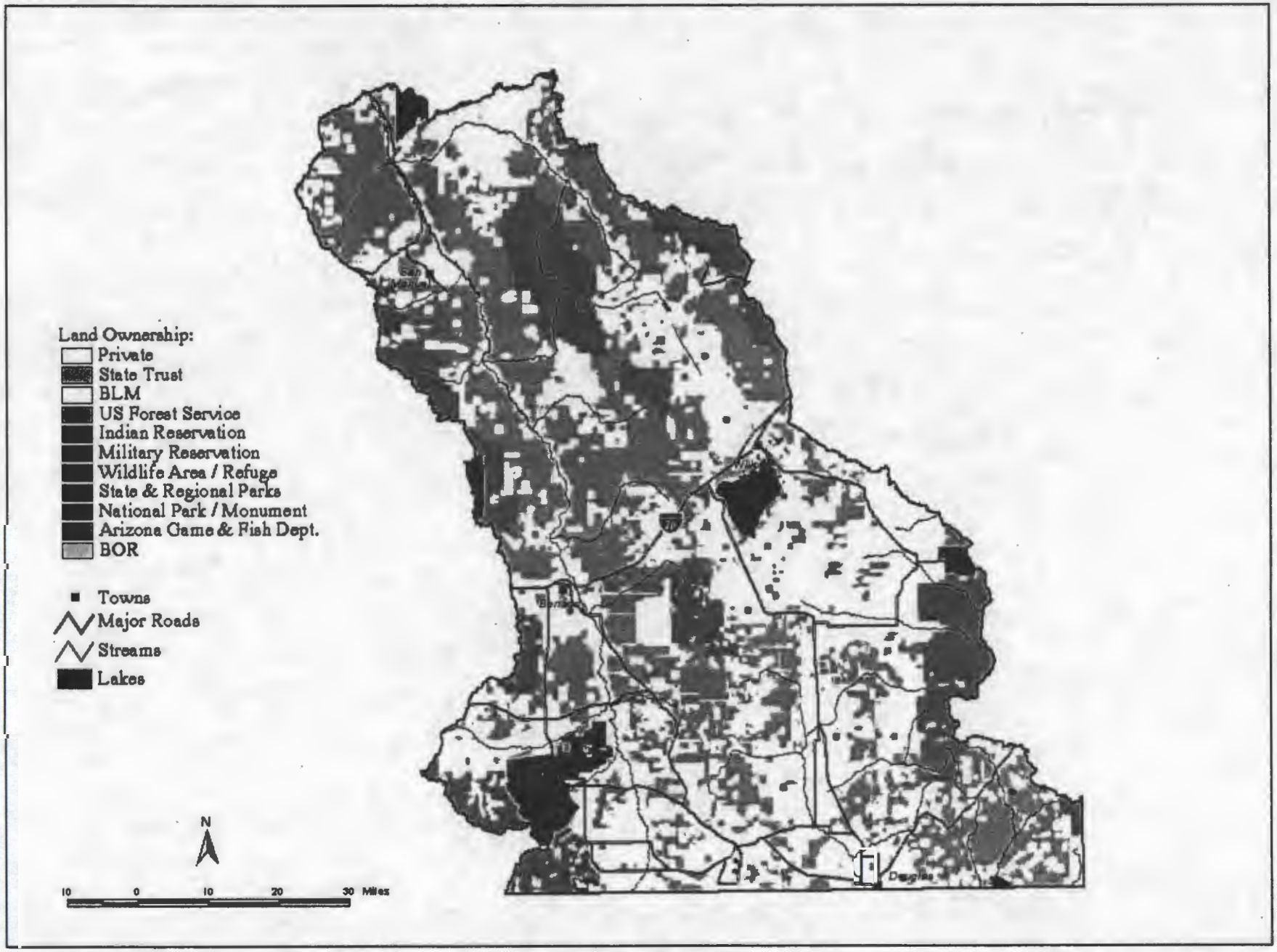

Figure 39. Land Ownership in the San Pedro-Willcox Playa-Rio Yaqui Watershed

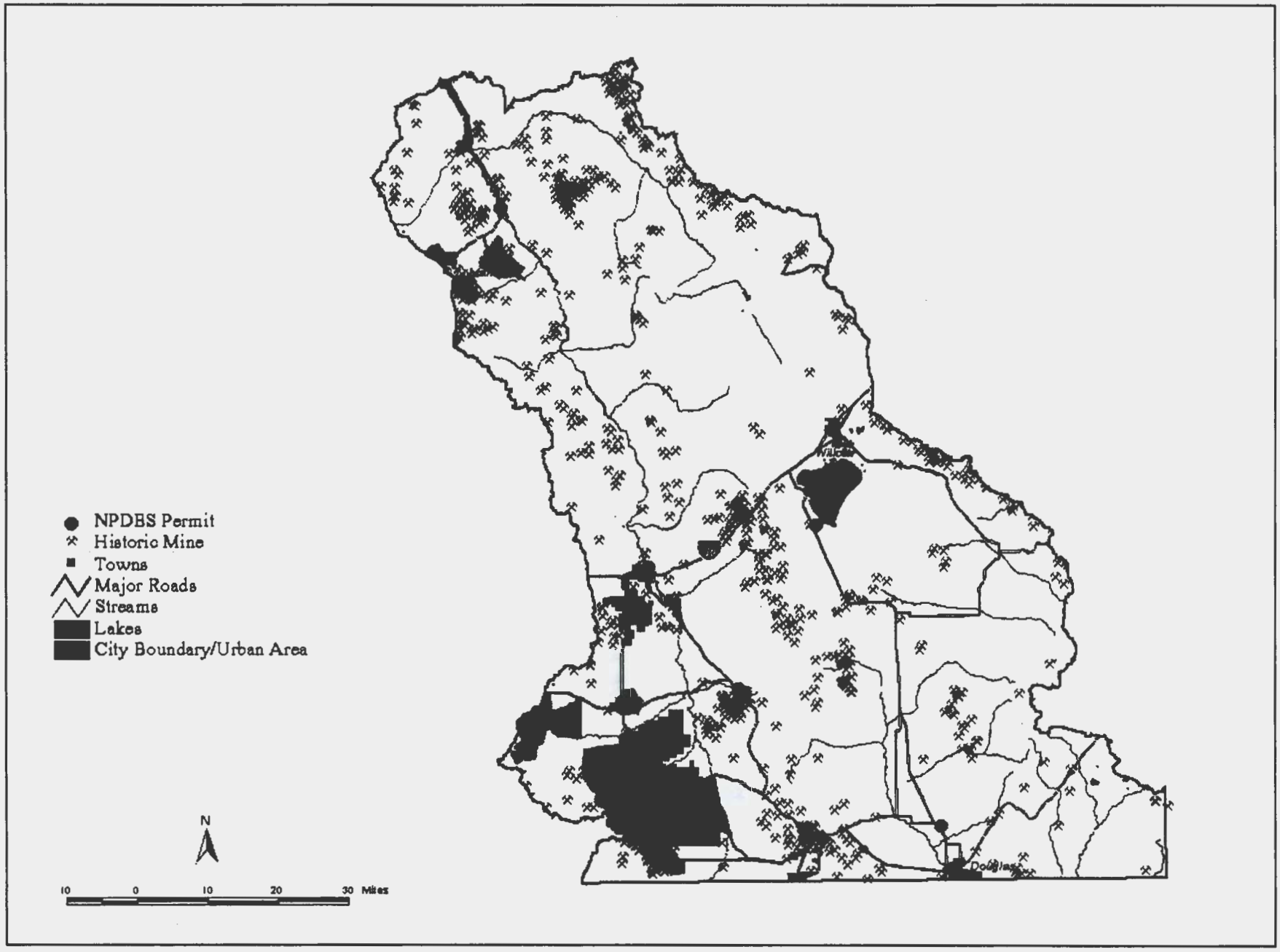

Figure 40. General Land Use and NPDES Permits in the San Pedro-Willcox Playa-Rio Yaqui Watershed

San Pedro-Willcox Playa-Rio Yaqui Watershed Assessment Discussion

Statistical Summary of Surface Water Assessments

Assessments – For the 2002 assessment, 244 miles of streams or washes and 10 acres of lakes were assessed. This assessment includes the water quality monitoring data collected in 2000 when this was one of two focus watersheds.

Water quality assessment information for the San Pedro-Willcox Playa-Rio Yaqui Watershed is summarized in the following tables and illustrated on **Figure 41**.

Table 21. Assessments in the San Pedro-Willcox Playa-Rio Yaqui Watershed – 2002

	STREAMS		LAKES	
	miles	number of segments	acres	number of lakes
ATTAINING	200	15	0	0
INCONCLUSIVE	14	3	10	2
IMPAIRED	30	5	0	0
NOT ATTAINING	0	0	0	0
TOTAL ASSESSED	244	23	10	2

PERENNIAL SURFACE WATERS ASSESSED		STREAMS		LAKES	
		miles	number of segments	acres	number of lakes
	Assessed	206	14	10	2

* Note that streams with significant perennial stretches within the reach assessed were included in the perennial milage although part of the reach may have ephemeral or intermittent flow.

Inconclusive assessments – Surface waters with some monitoring data, but insufficient data to determine if a designated use is attaining or impaired, were added to the new Planning List. By the end of the next watershed monitoring cycle (scheduled in 2005), ADEQ expects to monitor most of the surface waters on the Planning List so that all designated uses can be assessed during the following assessment cycle. Other lakes and streams which lack water quality monitoring data will also be monitored depending on resources and priorities.

ADEQ will be working with US Geological Survey and other state and federal agencies to collected monitoring data, so that their future monitoring efforts will better support Arizona's surface water assessments.

Major stressors – When a surface water is listed as impaired or not attaining a designated use, the pollutants or suspected pollutants causing the impairment are indicated. Impaired reaches can be divided into two problems:

- High nitrate levels seeping into the San Pedro River due to ground water contamination at the Apache Powder Superfund cleanup site; and
- Historic mining activities in the Bisbee, Arizona area that has lead to copper, zinc and low pH contamination of Mule Gulch and its tributaries.

Watershed assessment map
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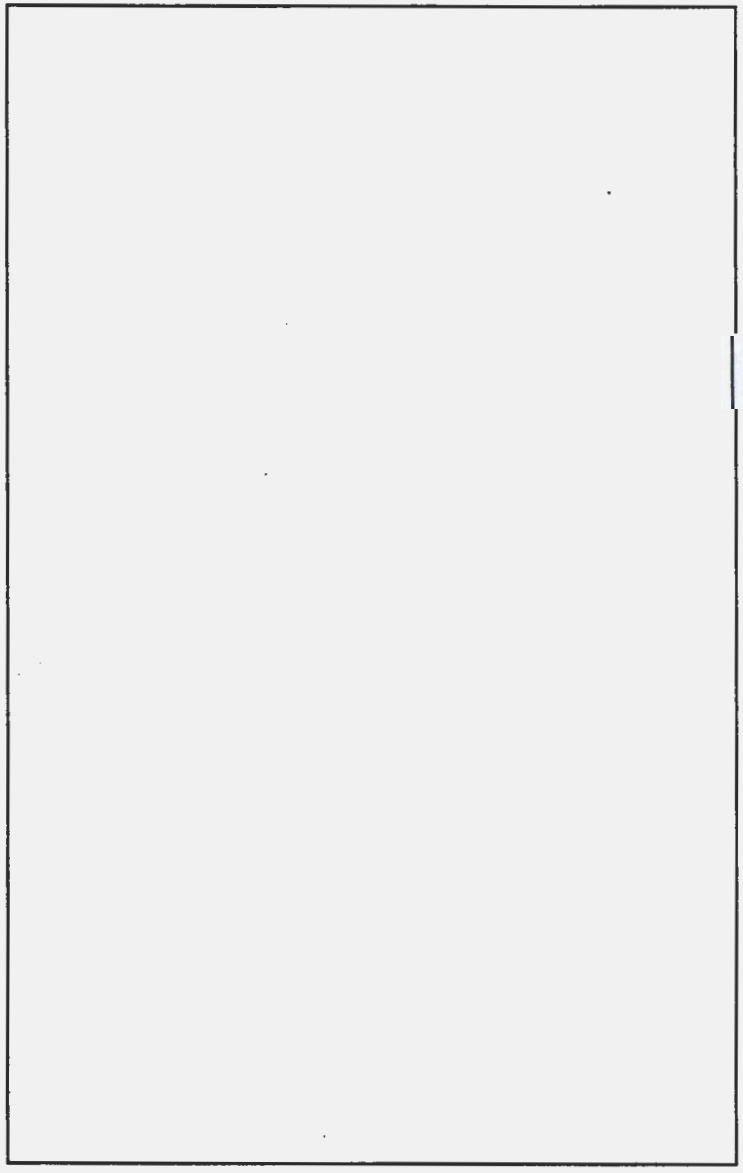

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
STREAM MONITORING DATA								
Aravaipa Canyon Creek headwaters-Stowe Gulch AZ15050203-004A A&Ww, FC, FBC, DWS, AgL	ADEQ Stream Ecosystem Monitoring Near springs SPARA012.45 100209	1998 - 1 suite	OK					
	Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Aravaipa Canyon Creek Stowe Gulch-Wilderness AZ15050203-004B A&Ww, FC, FBC, DWS, AgL	ADEQ Ambient and Bioassessment At Hells Half Acre (West end) SPARA007.92 100716	1997 - 1 suite(no bacterial samples) 2000 - 4 suites	OK					
	ADEQ Ambient and Bioassessment Below Parson's Canyon SPARA010.40 100211	1997 - 1 suite (no bacterial samples) 1998 - 1 suite (no bacterial samples) 2000 - 4 suites	OK					
	ADEQ Stream Ecosystem Monitoring At east trail head SPARA011.03 100210	1998 - 1 suite 2000 - 1 suite (no bacterial samples)	OK					
	Summary Row A&Ww Attaining FC Attaining FBC Attaining DWS Attaining AgL Attaining	1997 - 2000 13 samples 6 sampling events	OK				Attaining	ADEQ collected a total of 13 samples at 3 sites in 1997 - 2000. Reach assessed as "attaining all uses."
Aravaipa Canyon Creek Wilderness Area-San Pedro AZ15050203-004C A&Ww, FC, FBC, DWS, AgL	ADEQ Ecosystem Monitoring 5 miles from terminus SPARA002.96 100213	1998 - 1 suite	OK					Missing core parameters: bacteria.
	ADEQ Ecosystem Monitoring At Woods Ranch SPARA006.75 100212	1998 - 1 suite 2000 - 1 suite	OK					Missing core parameters: bacteria.

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive AgL Inconclusive	1997 - 2000 3 samples 2 sampling events Missing a core parameter	OK				Attaining	ADEQ collected a total of 3 samples at 2 sites from 1998 - 2000. Reach assessed as "inconclusive" and added to the Planning List due to lack of sampling events and missing bacteria samples.
Bass Canyon Creek headwaters-Hotsprings AZ15050203-899 A&Ww, FC, FBC	ADEQ Stream Ecosystem Monitoring Above Hot Springs Cyn Creek SPBAS000.24 100217	1998 - 1 suite	OK					Missing core parameters: bacteria
	ADEQ Fixed Station Network Above Double R Canyon SPBAS000.75 100215	2000 - 5 suites	OK					
	ADEQ Stream Ecosystem Monitoring At stream length 9.2 miles SPBAS001.54 100214	1998 - 1 suite	OK					Missing core parameters: bacteria
	Summary Row A&Ww Attaining FC Attaining FBC Attaining	1998 - 2000 7 samples 6 sampling events	OK				Attaining	ADEQ collected a total of 7 samples at 3 sites from 1998 - 2000. Reach assessed as "attaining all uses."
Unnamed trib. to Bass Canyon headwaters - Bass Canyon Cr. AZ15050203-935 A&Ww, FBC, FC	ADEQ Stream Ecosystem Monitoring Unnamed-east of Bass Canyon Creek SPUBS000.20 100224	1998 - 1 suite	OK					Missing core parameters: mercury and bacteria.
	Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient sampling events to assess.
Brewery Gulch Wildcat Canyon-Mule Gulch AZ15080301-337 A&We, PBC	ADEQ TMDL Program Above mineralized zone RMBRG000.90	2000 - 1 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	9 (A&We)	26	1 of 1		
	ADEQ TMDL Program At Mule Gulch RMBRG000.01	2000 - 4 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	Varies (A&We)	52 - 150	4 of 4		

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&We Impaired PBC Inconclusive	2000 5 samples 4 sampling events Missing core parameters	Copper (dissolved) µg/l	Varies (A&We)	26 - 150	5 of 5	Impaired	ADEQ collected a total of 5 samples at two sites in 2000. Reach assessed as impaired due to copper.
Buehman Canyon headwaters-end Unique Waters AZ15050203-010A A&Ww, FC, FBC, AgL Unique Waters	ADEQ Ambient Monitoring 2 miles below Bullock Canyon SPBHC002.46 100425	1998 - 1 suite 2000 - 4 suites	Dissolved oxygen mg/L	6.0 (90% saturation) A&Ww	2.38-8.26 (31- 98% saturation)	3 of 5		Naturally occurring low dissolved oxygen due to very low stream flow (less than 1 cfs) and ground water upwelling. Not included as exceedance in final assessment.
	ADEQ Fixed Station Network Above USFS Road 801 SPBHC003.90 100272	1996 - 5 suites 1997 - 4 suites (no bacterial samples)	Beryllium (total) µg/l	0.21 FC	1.3-2.0	8 of 8		Two other beryllium samples were not used because the Method Detection Limit was too high
			Dissolved oxygen mg/l	6.0 (90% saturation) A&Ww	5.42-7.78 (57% - 90.8% saturation)	2 of 6		Naturally occurring low dissolved oxygen due to ground water up-welling. Exceedances not included in final assessment.
	Summary Row A&Ww Attaining FC Inconclusive FBC Attaining AgL Attaining	1996 - 2000 14 sampling events	Beryllium (total) µg/l	0.21 FC	1.3-2.0	8 of 8	Inconclusive	ADEQ collected a total of 14 samples at t two sites from 1996 - 2000. Reach assessed as "attaining some uses" and added to the Planning List due to beryllium exceedances.
C - Canyon headwaters- Mule Gulch AZ15080301-342 A&We, PBC	ADEQ TMDL Program At Highway 80 RMCCN000.01	2000 - 1 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	47 (A&We)	55	1 of 1		
	Summary Row	2000 1 sampling event	Copper (dissolved) µg/l	47 (A&We)	55	1 of 1	Not assessed	Insufficient sampling events and parametric coverage to assess. Add to Planning List due to copper exceedance.
Copper Creek headwaters-Prospect Canyon AZ15050203-022A A&Ww, FC, FBC, AgL	ADEQ Ambient Monitoring Above Bluebird Mine drainage SPCOP007.09 100433	1998 - 1 suite (no bacteria) 2000 - 3 suites	OK					
	ADEQ Fixed Station Network Below Dark Canyon SPCOP005.80 100944	2000 - 4 suites	Dissolved oxygen mg/L	6.0 (90% saturation) A&Ww	5.95 - 9.91 (84% - 101% saturation)	1 of 4		Exceedance within equipment tolerance interval of +/- 0.2 mg/L. Exceedance not included in final assessment.
	Summary Row A&Ww Attaining FC Attaining FBC Attaining DWS Attaining AgL Attaining	1998 - 2000 8 sampling events	OK				Attaining	ADEQ collected a total of 8 samples at two sites from 1998 - 2000. Reach assessed as "attaining all uses."

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Double R Canyon Creek headwaters-Bass Cyn Creek AZ15050203-902 A&Ww, FC, FBC, AgL	ADEQ Stream Ecosystem Near Terminus SPDOU000.20 100223	1998 - 1 suite 2000 - 1 suite	Dissolved oxygen mg/l	6.0 (90% saturation) A&Ww	4.67 - 6.2 (59 - 70% saturation)	1 of 2		Missing core parameters: bacteria
	ADEQ Ambient Monitoring At stream length 4.2 miles SPDOU001.00 100222	1998 - 1 suite	Dissolved oxygen mg/l	6.0 (90% saturation) A&Ww	5.72 (61% saturation)	1 of 1		Missing core parameters: bacteria
	Summary Row A&Ww Inconclusive FC Attaining FBC Inconclusive DWS Attaining AgL Attaining	1998 - 2000 3 sampling events Missing core parameters	Dissolved oxygen mg/l	6.0 (90% saturation) A&Ww	4.67 - 6.2 (59 - 70% saturation)	2 of 3	Inconclusive	ADEQ collected a total of 3 samples at two sites from 1998 - 2000. Reach assessed as "attaining some uses" and added to Planning List due to low dissolve oxygen test results and missing bacteria samples.
Dubacher Canyon headwaters to Mule Gulch AZ15080301-075 A&We, PBC	ADEQ TMDL Program Below Highway 80 RMDBC000.01	2000 - 2 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	Varies (A&We)	36,000 - 78,000	2 of 2		
			pH(low) SU	6.5-9.0 (A&We, PBC)	2.30	1 of 1		
			Zinc (dissolved) µg/l	Varies (A&We)	1,500 - 2,500	2 of 2		
	Summary Row A&We Impaired PBC Inconclusive	2000 2 sampling events Missing core parameters	Copper (dissolved) µg/l	Varies (A&We)	15 - 76	2 of 2	Impaired	ADEQ collected a total of 2 samples at one site in 2000. Reach assessed as "impaired" due to copper and zinc. Also added to the Planning List due to low pH reading and missing core parameters.
			pH (low) SU	6.5-9.0 (A&We, PBC)	5.75 - 7.39	1 of 1	Inconclusive	
			Zinc (dissolved) µg/l	Varies (A&We)	1,500 - 2,500	2 of 2	Impaired	
Grant Creek headwaters-High Creek AZ15050201-033 A&Wc, FC, FBC, DWS, AgL	ADEQ Ambient Monitoring 1 mile below Post Creek WPGRA006.56 100561	1997 - 1 suite(no bacteria, fluoride) 2000 - 2 suites	OK					
	Summary Row A&Wc Attaining FC Attaining FBC Inconclusive DWS Inconclusive AgL Attaining	1997 - 2000 3 sampling events Missing core parameters	OK				Attaining	ADEQ collected 3 samples from 1997-2000. Reach assessed as "attaining some uses" and added to the Planning List due to missing core parameters.
Hendricks Gulch headwaters to Mule Gulch AZ15080301-335 A&We, PBC	ADEQ TMDL Program At confluence with Mule Gulch RMHNG000.01	2000 - 3 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	Varies (A&We)	15 - 76	1 of 3		
			pH (low) SU	6.5-9.0 (A&We, PBC)	5.75 - 7.39	1 of 2		

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&We Inconclusive PBC Inconclusive	2000 3 sampling events Missing core parameters	Copper (dissolved) µg/l	Varies (A&We)	15 - 76	1 of 3	Inconclusive	ADEQ collected 3 samples in 2000. Reach assessed as "inconclusive" due to insufficient samples and core parameters.
			pH (low) SU	6.5-9.0 (A&We, PBC)	5.75 - 7.39	1 of 2	Inconclusive	
Hot Springs Canyon Creek headwaters-San Pedro AZ15050203-013 A&Ww, FC, FBC, AgL	ADEQ Stream Ecosystem Monitoring Southwest of Wildcat Peak SPHSC006.04 100220	1998 - 1 suite	OK					Missing core parameters: bacteria
	ADEQ Ambient and Bioassessment Below Wildcat Canyon SPHSC006.13 100574	1997 - 1 suite (no bacterial samples) 2000 - 5 suites	OK					
	ADEQ Stream Ecosystem Monitoring Below Bass Canyon Creek SPHSC006.22 100219	1998 - 1 suite	OK					Missing core parameters: bacteria
	Summary Row A&Ww Attaining FC Attaining FBC Attaining AgL Attaining	1997 - 2000 8 samples	OK				Attaining	ADEQ collected a total of 8 samples at 3 sites in 1997-2000. Reach assessed as "attaining all uses."
Morales Creek headwaters-Mule Gulch AZ15080301-331 A&We, PBC	ADEQ TMDL Program Lat 31°27'07.1" Long 109°56'26.9" RMMOR000.40	2000 - 1 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	11 (A&We)	18	1 of 1		
	Summary Row	2000 1 sample	Copper (dissolved) µg/l	11 (A&We)	18	1 of 1	Not assessed	Insufficient sampling events to assess. Add to Planning List due to copper.
Miller Canyon Creek headwaters-San Pedro AZ15050202-409 A&Wc, FC, FBC, DWS, AgL	ADEQ Bioassessment Program Near headwaters SPMLC008.64 100592	1998 - 1 suite (no bacteria, total mercury, dissolved chromium/zinc)	OK					
	Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient sampling events and parametric coverage to assess.

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Mule Gulch headwaters-WWTP AZ15080301-090A A&Ww, FC, PBC, AgI, AgL	ADEQ TMDL Program Above C-Canyon RMMLG005.10	1999 - 1 pH, copper, zinc	Copper (dissolved) µg/l	Varies (64) (A&Ww)	1,200	1 of 1		
			Zinc (dissolved) µg/l	Varies (371) (A&Ww)	2,400	1 of 1		
			pH (low) SU	6.5-9.0 (A&Ww, PBC, AgI, AgL)	3.24	1 of 1		
	ADEQ TMDL Program At traffic circle RMMLG005.26 100507	1998 - 3 pH, copper, zinc	Copper (dissolved) µg/l	Varies (A&Ww)	2,356-10,050	3 of 3		
			Copper (total) µg/l	500 (AgL)	1,762-10,500	3 of 3		
			Zinc (dissolved) µg/l	Varies (A&Ww)	2,040-3,760	3 of 3		
			pH (low) SU	6.5-9.0 (A&Ww, PBC, AgI, AgL)	3.4-5.5	3 of 3		
	ADEQ TMDL Program Above mill site RMMLG005.28	1999 - 1 pH, copper, zinc	Copper (dissolved) ug/l	Varies (39) (A&Ww)	4,200	1 of 1		
			Zinc (dissolved) µg/l	Varies (237) (A&Ww)	240	1 of 1		
			pH (low) SU	6.5-9.0 (A&Ww, PBC, AgI, AgL)	3.07	1 of 1		
	ADEQ TMDL Program At Castle Rock (MG-2) RMMLG005.94 100506	1998 - 4 pH, copper, zinc	OK					
	ADEQ TMDL Program Below old mill site RMMLG011.25	2000 - 2 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) ug/l	Varies (A&Ww)	4000	2 of 2		
			Zinc (dissolved) µg/l	Varies (237) (A&Ww)	240 - 430	2 of 2		
			pH (low) SU	6.5-9.0 (A&Ww, PBC, AgI, AgL)	3.0	1 of 1		
	ADEQ TMDL Program At Lavender Pit RMMLG012.11	2000 - 5 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	Varies (A&Ww)	11 - 110	5 of 5		
			pH (low) SU	6.5-9.0 (A&Ww, PBC)	5.76 - 8.94	1 of 5		

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Ww Impaired FC Inconclusive PBC Inconclusive AgI Inconclusive AgL Inconclusive	1998 - 1999 9 samples Missing core parameters	Copper (dissolved) µg/l	Varies (A&Ww)	1,200 -10,050	12 of 16	Impaired	ADEQ collected a total of 9 samples at four sites in 1998-1999. Reach assessed as impaired due to copper and zinc. Reach also added to the Planning List due to low pH and missing core parameters.
			Copper (total) µg/l	500 (AgL)	1,762 -10,500	5 of 16	Inconclusive	
			Zinc (dissolved) µg/l	Varies (A&Ww)	240 - 3,760	7 of 16	Impaired	
			pH (low) SU	6.5-9.0 (A&Ww, PBC, AgI, AgL)	3.00 - 5.5	7 of 15	Inconclusive	
Mule Gulch WWTP-Whitewater Draw AZ15080301-090B A&Wedw, PBC, AgL	ADEQ TMDL Program At Elfrida cutoff RMMLG002.75 100225	1998 - 2 pH, copper, zinc	Copper (dissolved) µg/l	Varies (45-48) A&Wedw	76-118	2 of 2		
	ADEQ TMDL Program Below unnamed wash RMMLG004.22 100509	1998 - 3 pH, copper, zinc	Copper (dissolved) µg/l	Varies (33-39) (A&Wedw)	43-85	3 of 3		
	ADEQ TMDL Program Below WWTP RMMLG004.50 100508	1998 - 4 pH, copper, zinc	OK					
	ADEQ TMDL Program At MG-300 (aka FSN MG-1) RMMLG007.12	1999 - 1 pH, copper, zinc 2000 - 4 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) ug/l	Varies (A&Wedw)	62 - 12,000	3 of 5		
			Zinc (dissolved) µg/l	Varies (A&Wedw)	50 - 1,900	2 of 5		
			pH (low) SU	6.5-9.0 (A&Wedw, PBC, AgL)	3.16 - 8.58	2 of 5		
	ADEQ TMDL Program At MG-200 (old site) RMMLG009.26	1999 - 1 pH, copper, zinc 2000 - 1 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) ug/l	Varies (A&Wedw)	10 - 7,300	1 of 2		
			Zinc (dissolved) µg/l	Varies (A&Wedw)	50 - 2,600	1 of 2		
			pH (low) SU	6.5-9.0 (A&Wedw, PBC, AgL)	4.15 - 8.08	2 of 2		

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ TMDL Program At MG-200 (new site) RMMLG009.28	2000 - 4 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) ug/l	Varies (A&Wedw)	110 - 10,000	4 of 4		
			Zinc (dissolved) µg/l	Varies (A&Wedw)	110 - 2,600	4 of 4		
			pH (low) SU	6.5-9.0 (A&Wedw, PBC, AgL)	3.09 - 7.90	3 of 4		
	Summary Row A&Wedw: Impaired PBC: Impaired AgL: Impaired	1996-2000 20 samples (4 sampling events)	Copper (dissolved) µg/l	Varies (A&Wedw)	110 - 2,600	5 of 20	Impaired	ADEQ collected a total of 20 samples at 4 sites from 1996-2000. Reach assessed as "Impaired" due to copper, zinc, and low pH.
			pH (low) SU	6.5-9.0 (A&Wedw, PBC, AgL)	3.09 - 8.08	7 of 20	Impaired	
			Zinc (dissolved) µg/l	Varies (A&Wedw)	110 - 2,600	5 of 20	Impaired	
Mural & Grassy Hill Tributary headwaters to Mule Gulch AZ15080301-344 A&We, PBC	ADEQ TMDL Program At Mule Gulch RMMHC000.01	2000 - 1 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	8 (A&We)	15	1 of 1		
	Summary Row	2000 1 sample	Copper (dissolved) µg/l	8 (A&We)	15	1 of 1	Not assessed	Insufficient sampling events and parametric coverage to assess.
Paige Creek headwaters-San Pedro AZ15050203-823 A&Ww, FC, FBC, AgI, AgL	ADEQ Biocriteria program Below Hells Gate SPPAI007.50 100616	1996 - 1 suite	OK					
	Summary Row	1996 1 sample/event	OK				Not assessed	Insufficient sampling events to assess.
Ramsey Canyon Creek headwaters-San Pedro AZ15050202-404 A&Wc, FC, FBC, DWS, AgI, AgL	ADEQ Ambient and Bioassessment Above Nature Conservancy SPRMC007.43 100625	1998 - 1 suite(no bacterial samples) 2000 - 2 suites	OK					
	ADEQ Fixed Station Network SPRMC007.18 101060	2000 - 2 suites	OK					

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Wc Attaining FC Attaining FBC Attaining DWS Attaining AgI Attaining AgL Attaining	1996 - 2000 5 sampling events	OK				Attaining	ADEQ collected a total of 5 samples at 2 sites in 1998 - 2000. Reach assessed as "attaining all uses."
Redfield Canyon headwaters-San Pedro River AZ15050203-014 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program Below Sycamore Canyon SPRDC006.89	1997 - 1 suite (no bacteria or boron)	OK					No bacterial or boron samples included in parametric coverage.
	Summary Row	1997 1 sampling event	OK				Not assessed	Insufficient sampling events to assess.
Rucker Canyon Creek headwaters- Whitewater Draw AZ15050101-288 A&Wc, FC, FBC, DWS, AgL	ADEQ Fixed Station Network Above upper-most campsite RMRUC005.63 100938	2000 - 4 suites	Dissolved oxygen mg/L	7 (90% saturation) (A&Wc)	6.38 - 7.88 (77 - 95% saturation)	1 of 4		Naturally low dissolved oxygen during low flow (less than 1 cfs); therefore, not included as exceedence in final assessment.
	Summary Row A&Wc Attaining FC Attaining FBC Attaining DWS Attaining AgL Attaining	2000 4 samples	OK				Attaining	ADEQ collected 4 samples in 2000. Reach assessed as "attaining all uses."
San Pedro River Mexico border-Charleston AZ15050202-008 A&Ww, FC, FBC, AgI, AgL	USGS Station #09471000 At Charleston SPSPR096.49 100747	1996 - 9 suites 1997 - 13 suites 1998 - 12 suites 1999 - 8 suites 2000 - 10 suites	Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	5.6-9.9	5 of 52		Missing core parameters: turbidity, and only 5 beryllium analyses performed.
	ADEQ Stream Ecosystem Monitoring At Charleston Road SPSPR096.49 100291	2000 - 1 suite	OK					
	ADEQ Fixed Station Network Near Palominas SPSPR113.55 100275	1996 - 4 suites 1997 - 3 suites 1998 - 4 suites 1999 - 3 suites 2000 - 3 suites	Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	5.58-10.1 (79% - 110% saturation)	1 of 15		Naturally low dissolved oxygen during low flow (less than 1 cfs); therefore, not included as exceedence in final assessment.
			Beryllium µg/l	0.21 (FC)	0.61	1/1		15 other beryllium samples were not counted because the Method Detection Limit was too high.
			Turbidity NTU	50 (A&Ww)	0.89 - 460	2 of 17		

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Ww Attaining FC Inconclusive FBC Attaining Agl Attaining AgL Attaining	1996 - 2000 70 sampling events	Dissolved oxygen mg/l	6.0 (80% saturation) (A&Ww)	5.58-10.1 (75% - 110% saturation)	6 of 68	Attaining	ADEQ and USGS collected a total of 70 samples at two sites in 1996 - 2000. Reach assessed as "attaining some uses." Add to Planning List due to beryllium exceedance.
			Beryllium µg/l	0.21 (FC)	0.51	1 of1	Inconclusive	
			Turbidity NTU	50 (A&Ww)	0.89 - 460	2 of 18	Attaining	
San Pedro River Charleston-Walnut Gulch AZ15050202-006 A&Ww, FC, FBC, Agl, AgL	ADEQ Fixed Station Network Below Graveyard Gulch SPSPR095.71 100653	2000 - 4 suites	Turbidity NTU	50 (A&Ww)	1.41 - 258	1 of 4		
	Summary Row A&Ww Inconclusive FC Attaining FBC Attaining Agl Attaining AgL Attaining	2000 4 sampling events	Turbidity NTU	50 (A&Ww)	1.41 - 258	1 of 4	Inconclusive	ADEQ collected 4 samples at one site in 2000. Reach assessed as "attaining some uses" and added to the Planning List due to turbidity exceedance.
San Pedro River Babocomari -Dragoon Wash AZ15050202-003 A&Ww, FC, FBC, Agl, AgL	ADEQ Fixed Station Network 0.8 miles south of HWY 80 SPSPR077.66 100281	2000 - 4 suites	*Escherichia coli* CFU/100 ml	580 (FBC)	39 - 660	1 of 4		
	Hargis & Assoc. CERCLA Monitoring Below Apache Nitrogen Prod. SPSPR079.71	1998 - 4 suites 1999 - 3 suites 2000 - 3 suites	OK					Missing core parameters: flow, DO, turbidity, pH, nitrogen, phosphorus, metals, E. coli, and boron.
	Summary Row A&Ww Attaining FC Attaining FBC Inconclusive Agl Attaining AgL Attaining	1998 - 2000 14 sampling events	*Escherichia coli* CFU/100 ml	580 (single sample maximum) FBC	39-660	1 of 4	Inconclusive	ADEQ collected 4 samples and Hargis & Associates collected 10 samples at separate sites in 1998 - 2000. Reach assessed as "attaining some uses" and added to the Planning List due to bacteria exceedance.
San Pedro River Dragoon Wash-Tres Alamos AZ15050202-002 A&Ww, FC, FBC, Agl, AgL	Hargis & Assoc. CERCLA Monitoring Above Apache Nitrogen Products SPSPR076.35	1996 - 4 suites 1997 - 4 suites 1998 - 4 suites 1999 - 2 suites 2000 - 3 suites	OK					Missing core parameters: flow, DO, turbidity, pH, nitrogen, phosphorus, metals, E. coli, and boron.
	Hargis & Assoc. CERCLA Monitoring Mid Apache Nitrogen Products SPSPR077.31	1996 - 4 suites 1997 - 4 suites 1998 - 4 suites 1999 - 3 suites 2000 - 4 suites	Nitrate (as nitrogen) mg/l	10 (A&Ww)	0.43-22.6	5 of 20		Missing core parameters: flow, DO, turbidity, pH, nitrogen, phosphorus, metals, E. coli, and boron.

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Ww Impaired FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	1996 - 2000 36 samples 19 sampling events Missing core parameters	Nitrate (as N) mg/l	10 (A&Ww)	0.43-22.6	5 of 20	Impaired	Hargis and Associates collected a total of 36 samples at two sites in 1996 - 2000. Reach assessed as "impaired" due to nitrate and was added to the Planning List due to missing core parameters.
San Pedro River Hot Springs Cr.-Redfield Cyn. AZ15050203-011 A&Ww, FC, FBC, AgI, AgL	ADEQ Ambient Monitoring Program Near Cascabel SPSPR046.96 100289	2000 - 5 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.59 - 9.81 (63 - 93% saturation)	2 of 5		Naturally low dissolved oxygen due to ground water up-welling Exceedance not included in final assessment.
			Escherichia coli CFU/100 ml	580 (FBC)	4 - 16,000	1 of 4		Flood conditions present.
			Fecal Coliform CFU/100 ml	4000 (A&Ww, AgL, AgI)	5 - 6000	1 of 4		Flood conditions present.
			Tubidity NTU	50 (A&Ww)	2.37 - 1000	1 of 5		Flood conditions present.
	Summary Row A&Ww Inconclusive FC Attaining FBC Inconclusive AgI Inconclusive AgL Inconclusive	2000 5 sampling events	*Escherichia coli* CFU/100 ml	580 (FBC)	4 - 16,000	1 of 4	Inconclusive	ADEQ collected 5 samples in 2000. Reach assessed as "attaining some uses" and added to the Planning List due to bacteria and turbidity exceedances.
			Fecal Coliform CFU/100 ml	4000 (A&Ww, AgL, AgI)	5 - 6000	1 of 4	Inconclusive	
			Tubidity NTU	50 (A&Ww)	2.37 - 1000	1 of 5	Inconclusive	
San Pedro River Aravaipa Creek-Gila River AZ15050203-001 A&Ww, FC, FBC, AgL	ADEQ Ambient and Bioassessment Below Eskiminzin Wash SPSPR003.74 100726	1998 - 1 suite 2000 - 5 suites	*Escherichia coli* CFU/100 ml	580 (FBC)	3-600	1 of 4		
			Turbidity NTU	50	1.70 - 1000	1 of 6		
	Summary Row A&Ww Inconclusive FC Attaining FBC Inconclusive AgL Attaining	1998 - 2000 6 sampling events	*Escherichia coli* CFU/100 ml	580 (FBC)	3-600	1 of 4	Inconclusive	ADEQ collected 6 samples in 1998 - 2000. Reach assessed as "attaining some uses" and added to the Planning List due to bacteria and turbidity exceedances.
			Turbidity NTU	50 (A&Ww)	1.70 - 1000	1 of 6	Inconclusive	
Spring Canyon Creek headwaters to Mule Gulch AZ15080301-333 A&We, PBC	ADEQ TMDL Program At confluence with Mule Gulch RMSPC000.10	2000 - 1 DO, pH, total/dissolved cadmium, copper, lead, zinc	OK					Missing core parameters.
	Summary Row	2000 1 sampling event	OK				Not assessed	Insufficient sampling events and parametric coverage to assess.

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Ward Canyon headwaters-Turkey Creek AZ15050201-433 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Above Salisbury Canyon WPWRC000.31 100682	1998 - 1 suite	OK					
	Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient sampling events to assess.
Winwood Canyon headwaters-Mule Gulch AZ15080301-340 A&We, PBC	ADEQ TMDL Program At Mural Hill Tributary RMWMC000.66	2000 - 1 DO, pH, total/dissolved cadmium, copper, lead, zinc	Copper (dissolved) µg/l	22 (A&We)	28	1 of 1		
	ADEQ TMDL Program Above Old Mill Site, Below Mineralized Zone RMWMC000.37	2000 - 1 DO, pH, total/dissolved cadmium, copper, lead, zinc	pH (low) SU	6.5-9.0 (A&We, PBC)	6.02	1 of 1		
	Summary Row A&We Inconclusive PBC Inconclusive	2000 2 samples 1 sampling event Missing core parameters	Copper (dissolved) µg/l	22 (A&We)	28	1 of 2	Inconclusive	ADEQ collected a total of 2 samples at 2 sites. Reach assessed as "inconclusive" and added to the Planning List due to lack of sampling events, copper and pH exceedances, and missing core parameters.
			pH (low) SU	6.5-9.0 (A&We, PBC)	6.02	1 of 2	Inconclusive	
Whitewater Draw Mule Gulch-Mexico border AZ15080301-002 A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Program At border with Mexico RMWHD005.99 100512	1998 - 4 pH, arsenic, beryllium, copper, lead, manganese, zinc	OK					
	ADEQ TMDL Program At International Border RMWHD0.016 101069	2000 - 1 arsenic, beryllium	OK					
	ADEQ TMDL Program At Highway 60 RMWHD001.33 100510	1998 - 1 pH, arsenic, beryllium, copper, lead, manganese, zinc	Manganese (total) µg/L	10,000 (AgI)	16,500	1 of 1		
	Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Attaining	1998 - 2000 6 sampling events	Manganese (total) µg/L	10,000 (AgI)	16,500	1 of 5	Inconclusive	ADEQ collected a total of 6 samples at 3 sites in 1998-2000 as part of a TMDL investigation. Reach assessed as "attaining some uses" and added to the Planning List due to lack of core parameters and one manganese exceedance.
Whitewater Draw, Mule Gulch-Elfrida Hwy AZ15080301-004 A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Program At Kings Highway RMWHD006.60 100229	1998 - 1 pH, arsenic, beryllium, copper, lead, manganese, zinc	Lead (total) µg/l	100 (AgL)	116	1 of 1		Not all core parameters sampled.

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row	1998 1 sample	Lead (total) µg/l	100 (AgL)	116	1 of 1	Not assessed	Insufficient sampling events to assess.
LAKE MONITORING DATA								
Riggs Flat Lake AZL15050201-1210 A&Wc, FC, FBC, Agl, AgL	ADEQ Lakes Program WPRIG-A 100074	1998 - 2 suites Missing core parameters: E. coli	pH SU	6.5-9.0 (A&Wc, FBC, Agl, AgL)	6.42-9.05	2 of 2		High and low pH readings within equipment tolerance interval of +/- 0.2 SU; therefore, not included as exceedances in final assessment.
			Turbidity NTU	10 (A&Wc)	0.8-17.4	1 of 1		
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	1998 2 sampling events Missing core parameters	Turbidity NTU	10 A&Wc	0.8-17.4	1 of 1	Inconclusive	ADEQ collected 2 samples in 1998. Lake assessed as "inconclusive" and added to the Planning List due to insufficient sampling events and core parameters.
Snow Flat Lake AZL15050201-1420 A&Wc, FBC, FC, Agl, AgL	ADEQ Lake Program WPSNO-A 100084	1998 - 2 suites (no E. coli samples)	pH SU	6.5-9.0 (A&Wc, FBC, AgL)	6.32-7.42	1 of 2		Low pH readings within equipment tolerance interval of +/- 0.2 SU; therefore, not included as exceedances in final assessment.
			Dissolved Oxygen mg/L	7 (90% saturation)	6.35-6.38	1 of 1		Low dissolved oxygen reading within equipment tolerance interval of +/- 0.2 mg/L; therefore, not included as an exceedance in final assessment.
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	1998 2 samples Missing core parameters	OK				Inconclusive	ADEQ collected 2 samples in 1998. Lake assessed as "inconclusive" and added to the Planning List due to insufficient sampling events and core parameters.

Information for Interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from using AZ (for streams) or AZL (for lakes) + Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses", "Agency", and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" -- This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" -- The year and number of water samples is shown. The federal "water year is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
  - "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among samples as many different programs and agencies provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
  - "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
  - If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters
- "Standards Exceeded at this Site per Sampling Event."

- Although many parameters may be analyzed, only those exceeding a standard are shown.
- "OK" indicates that no standards were exceeded.
- The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
- "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
- A mean or geometric mean will be shown along with the range of results if applicable to the standard.

- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or " Inconclusive." See assessment criteria in Chapter III of Volume I.

Major ground water pollutants -- Monitoring data collected from wells in this watershed between October 1995-October 2000 are summarized in **Table 23** and illustrated in **Figures 42, 43, and 44.**

Of approximately 246 wells monitored, 18 exceeded fluoride standards, 12 exceeded standards for metals, 7 exceeded standards for radiochemicals, and 7 exceeded nitrate standards. **Figure 42** illustrates the location of the wells monitored and the wells exceeding standards. Exceedances occurred across the watershed, rather than in an isolated area; however, most of the radiochemical and fluoride exceedances occurred in the northern half of the watershed.

TDS concentrations -- Water quality can be characterized based on concentration of Total Dissolved Solids (TDS). High levels of salinity limits the practical uses of ground water in some areas of this watershed as TDS over 500 mg/L has an off-flavor (23% of wells monitored), and TDS over 1000 mg/L will limit its use for some crops (7% of wells monitored). As illustrated in **Figure 43**, the elevated TDS is scattered across the watershed.

No TDS water quality standards apply in this watershed and the elevated levels of TDS do not present a human-health concern for drinking water. The TDS concentration is only used to generally characterize water quality.

Nitrate concentrations -- Water quality can also be characterized by looking at the concentration of nitrates in ground water. In Arizona, natural occurring nitrate concentrations in ground water are generally below 3 mg/L and concentrations above 5 mg/L indicate potential anthropogenic sources of nitrates. A total of 27 wells of the 236 wells sampled (11%) exceeded the 5 mg/L concentration. As illustrated in **Figure 44**, elevated nitrates occur in the Willcox Playa area and scattered across the southern portion of this watershed. Irrigated agriculture, septic systems, and other wastewater disposal facilities are may be sources of this nitrate.

When nitrate concentrations exceed 10 mg/L, the water may present a health problem for babies and should not be consumed by nursing mothers. Seven wells exceeded this level. As many of the wells sampled are irrigation wells (not used for drinking water), nitrates over 10 mg/L may not represent a human-health concern in this watershed. However, efforts should be made to minimize further contamination of ground water by nitrate.

Table 23. San Pedro-Willcox Playa-Rio Yaqui Watershed Ground Water Monitoring 1996 - 2000

MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	54		5	9%
	Fluoride	126		4	3%
	Metals/Metaloids	126		0	0%
	Nitrate	126		5	4%
	VOCs + SVOCs*	62	4	0	0%
	Pesticides	62	0	0	0%
TARGETED MONITORING WELLS	Radiochemicals	38		2	5%
	Fluoride	115		14	12%
	Metals/metaloids	120		12	10%
	Nitrate	110		2	2%
	VOCs + SVOCs*	37	0	0	0%
	Pesticides	37	0	0	0%

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
223	172	36	12	3

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
236	209	20	7

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.

*The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.

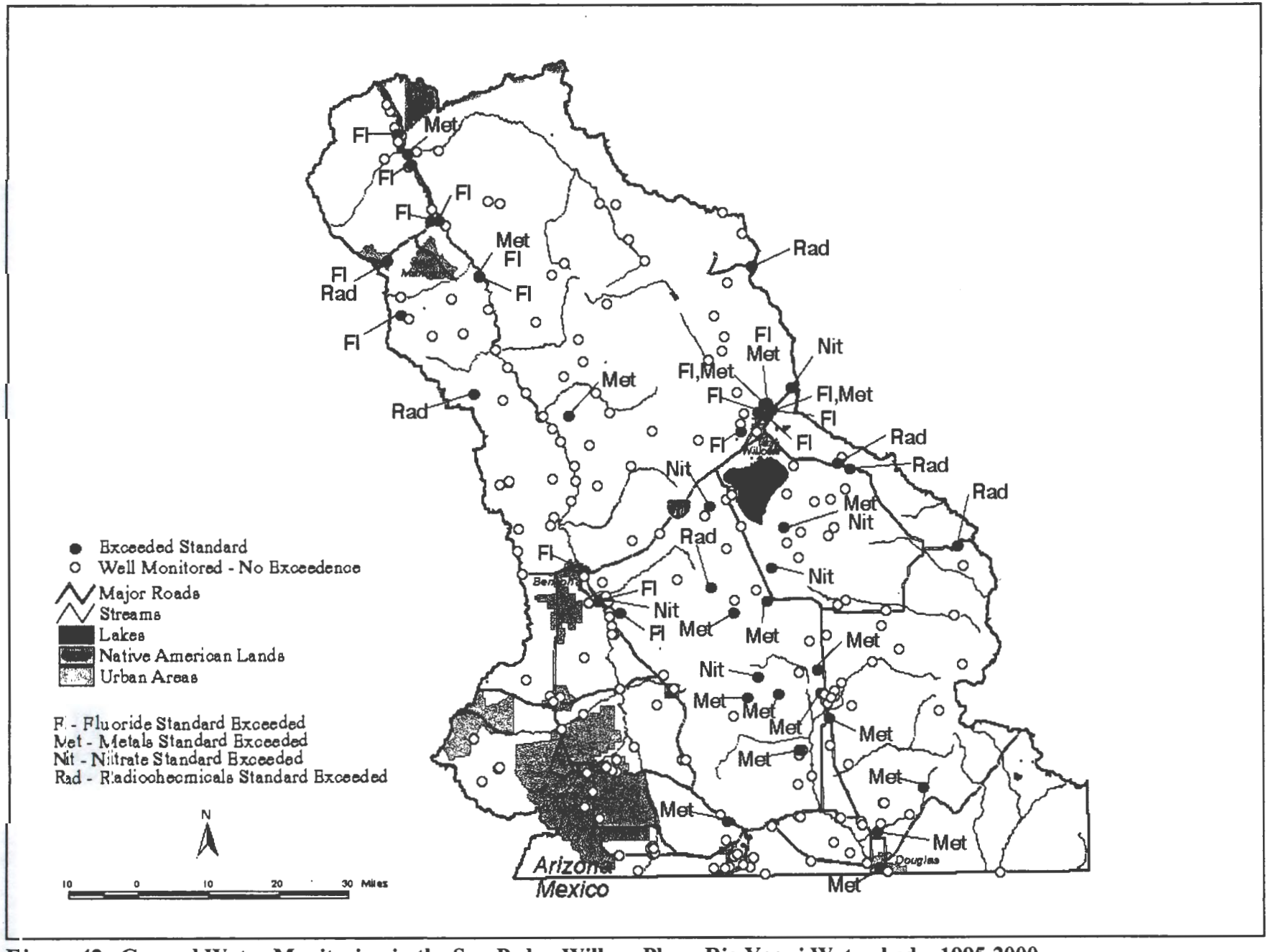

Figure 42. Ground Water Monitoring in the San Pedro-Willcox Playa-Rio Yaqui Watershed – 1995-2000

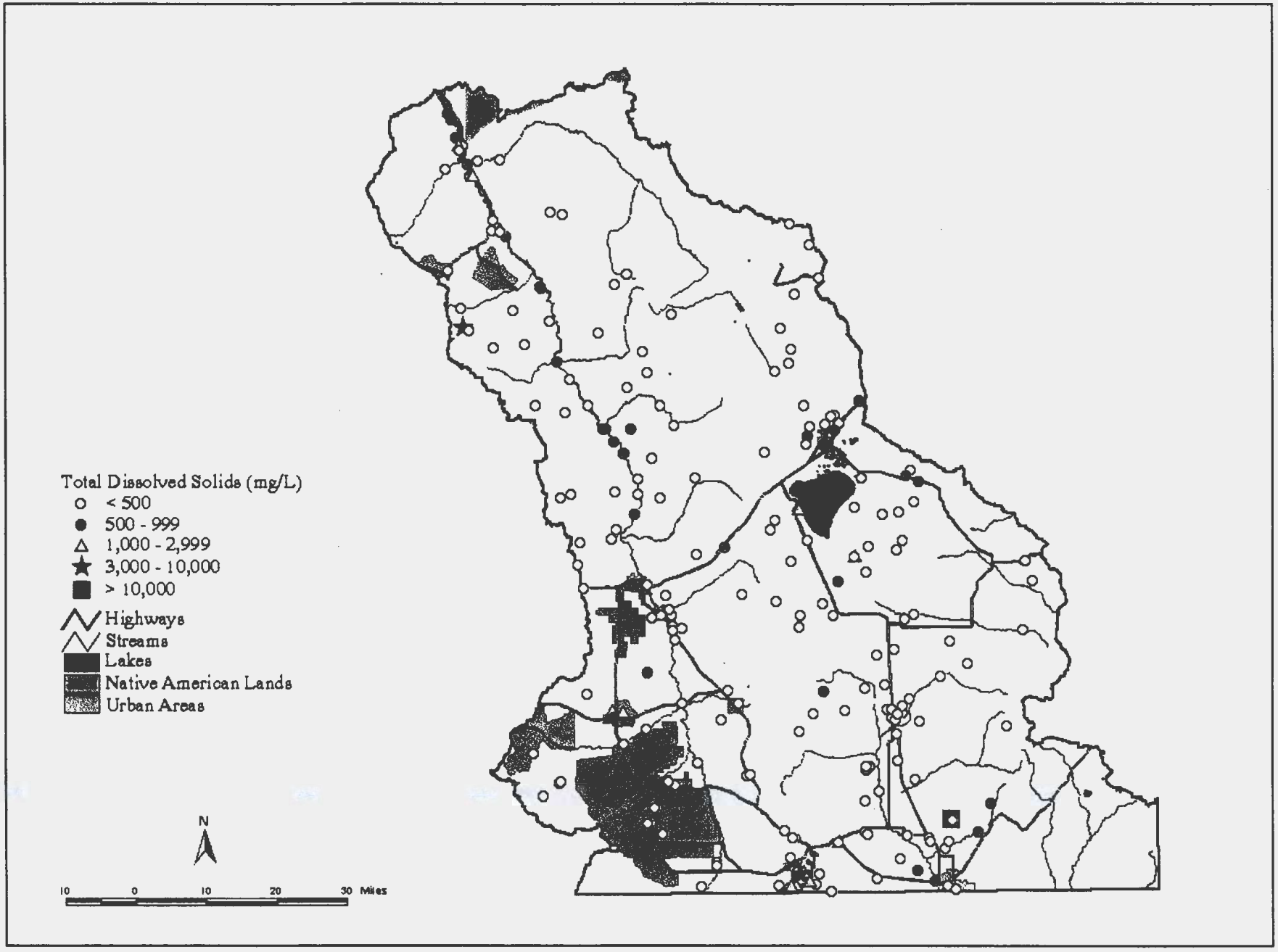

Figure 43. Classification of Ground Water Quality by TDS Concentration -- San Pedro-Willcox Playa-Rio Yaqui Watershed

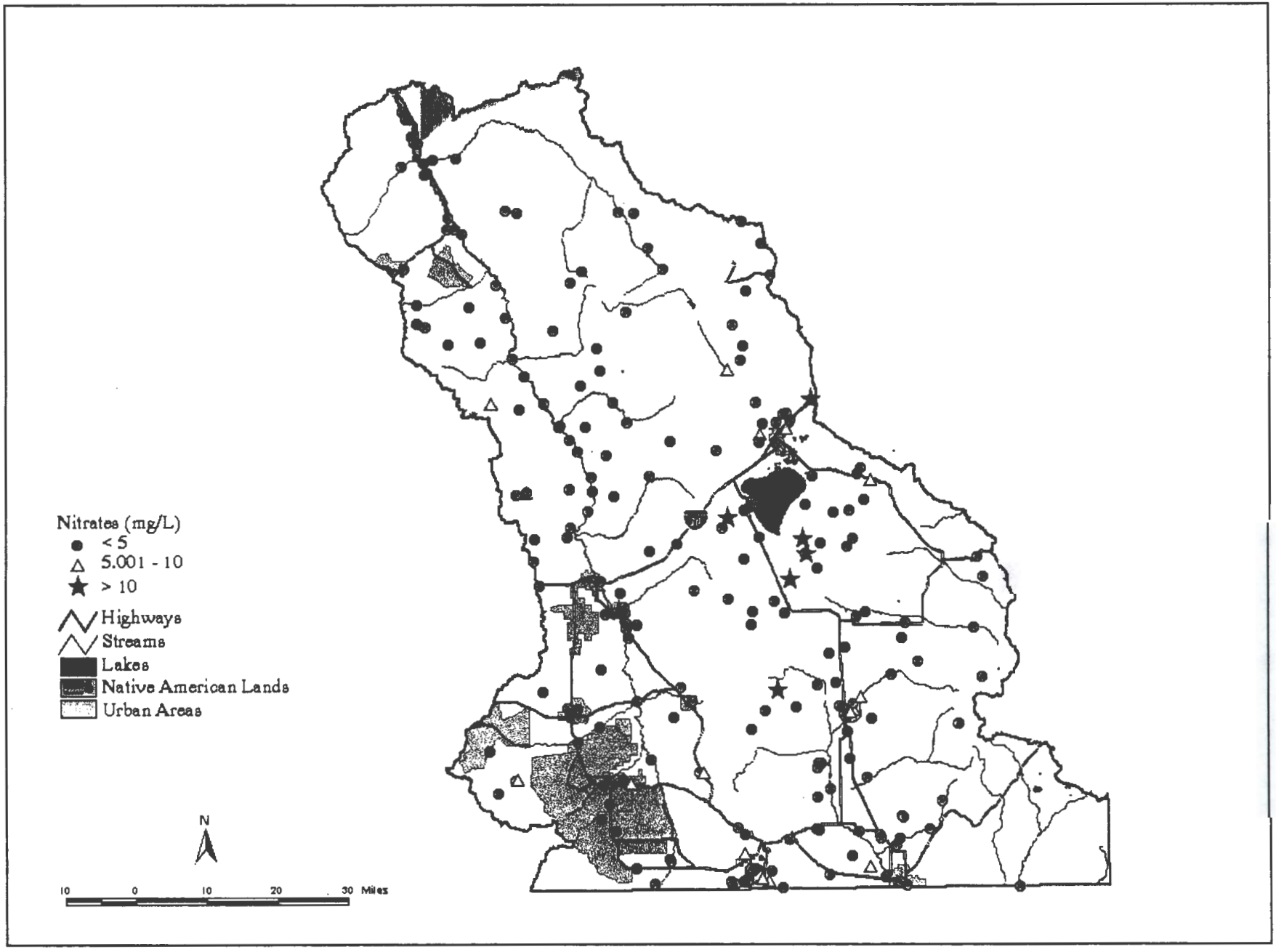

Figure 44. Classification of Ground Water by Nitrate Concentration – San Pedro-Willcox Playa-Rio Yaqui Watershed

Watershed Studies and Alternative Solutions in the San Pedro-Willcox Playa-Rio Yaqui Watershed

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the San Pedro-Willcox Playa-Rio Yaqui Watershed. Watershed partnerships active in this watershed are also discussed.

Surface Water Studies and Mitigation Projects

Total Maximum Daily Load Analyses – Two TMDL studies are ongoing in this watershed. Further information about the status of these investigations can be obtained by contacting the TMDL Program manager at (602) 207- 4468, or at ADEQ's web site: http://www.adeq.state.az.us/environ/water/assess.

- Mule Gulch TMDL – Mule Gulch was included on the 1998 303(d) List due to impairment by copper, zinc, and low pH. To develop a TMDL for this surface water, eighteen water samples have been collected since 1998 from seven sites along Mule Gulch from its headwaters to Whitewater Draw. ADEQ expects to complete a draft TMDL in the Fall of 2001.

- Whitewater Draw TMDL – Whitewater Draw, from Mule Gulch to the international border with Mexico is listed as impaired due to arsenic, beryllium, copper, lead, manganese, zinc, low dissolved oxygen, and turbidity. The primary source of these heavy metals is believed to be Mule Gulch; therefore, ADEQ has focused its efforts on monitoring and modeling loadings in Mule Gulch. Field observations have indicated that only a small segment (about 0.3 miles) of this reach at the international border is perennial. The intermittent or ephemeral nature of the stream should lead to delisting the low dissolved oxygen. Currently, no target date has been established for completing the Whitewater Draw draft TMDL.

NAWQA Study – Samples were collected in this watershed as part of the US Geological Survey's National Water Quality Assessment Program. This study included sites in the Middle Gila, Santa Cruz-Rio Magdalena-Rio Sonoyta, and Verde watersheds. See the discussion of this research effort in the statewide studies section at the beginning of Volume II.

Water Protection Fund Projects – The following projects received Water Protection Funds from the Arizona Department of Water Resources:

- San Pedro Riparian National Conservation Area Watershed Rehabilitation and Restoration Project – The Bureau of Land Management (BLM) was awarded funds to rehabilitate and restore approximately 4,450 acres of eroded, ephemeral washes and upland areas that are within a mile of the San Pedro River within the San Pedro Riparian National Conservation Area. This was accomplished by recontouring ephemeral washes and adjacent uplands and by revegetating these areas with native plant species. The project was completed in April 2000.

- San Pedro Riparian National Conservation Area Watershed Protection and Improvement Project – The BLM was awarded funds to improve, enhance and protect the riparian habitats and water quality in the San Pedro National Riparian Conservation Area. Part of the funds were spent on fencing off 36 miles of the San Pedro River from livestock. This project will enhance the riparian ecosystem and associated wildlife habitats without undue impacts to upland grazing allotments. The project was completed in September 1998.

- San Pedro River Preserve Riparian Habitat Restoration Project – The intent of this project is to enhance and protect existing riparian forest along three miles of the San Pedro River. The Nature Conservancy restored native grassland communities on the river slopes and terraces, determined the need for mechanical stabilization measures and implemented measures to stabilize river banks and re-established native riparian vegetation in areas of defunct aquaculture ponds and agricultural fields on a site encompassing 860 acres. The Conservancy also developed and demonstrated new techniques for restoring abandoned agriculture fields to riparian habitat. The project was completed in August 2001.

- Teran Watershed Enhancement Project – The Redington Natural Resource Conservation District received funds to improve watershed conditions within the Teran sub-watershed, located along the San Pedro River. Thousands of small, loose-rock dam structures have been

constructed in an attempt to reduce surface water runoff rates, increase duration of channel flow, improve ground water recharge and enhance habitat for wildlife. The project was completed in April 1999.

- Klondyke Tailings Response Strategy Analysis – A team of scientists led by the Arizona Department of Environmental Quality collected data to determine the extent of impact on Aravaipa Creek from runoff or leaching of contaminated mine tailings at the Klondyke Mine tailings pile. The team developed a response strategy to determine the best methods of treating the tailings pile to reduce or prevent ground water and stream contamination by leaching, runoff or erosion of the tailings into the stream. This project was completed in 1998.

- Happy Valley Riparian Restoration Area Restoration Project – The Paige Creek riparian area in Happy Valley is a unique, large riparian gallery located on the east side of the Rincon Mountains. The Coronado National Forest received a grant to fence the riparian area, create upland water sources for grazing wildlife, construct an in-stream structure to reduce water velocity, and construct a pipe barrier fence to restrict vehicle access to sensitive areas. This project which was completed in July 1999.

- Lyle Canyon Allotment Restoration Project – A private land owner was awarded funds to restore and protect the riparian areas on the Lyle Canyon Allotment through the installation of a variety of range improvements, including fences and upland water developments that will better distribute cattle grazing in the upland portions of the allotment and away from the riparian areas. The grantee and the University of Arizona Cooperative Extension Office have developed a monitoring plan to record the condition of riparian and upland habitats on the Lyle Canyon Allotment. The monitoring plan includes a quantitative assessment of the riparian and upland vegetation, a "Proper Functioning Condition" assessment of the riparian areas, and photo point monitoring. If livestock grazing management changes are indicated by the monitoring data the grantee will coordinate with the U.S. Forest Service to incorporate those into the Allotment Management Plan. The project was completed in October 2001.

Water Quality Improvement Grants – ADEQ awarded the following Water Quality Improvement Grants in this watershed:

- Upper Whitewater Draw Treatment and Management Project – The Whitewater Draw Natural Resource Conservation District received a grant to reduce erosion and siltation and enhance riparian conditions within Whitewater Draw through the following actions:

  - Improve understory and range vegetation by 50% or greater on 160 acres within the upper Whitewater Draw project area due to brush management techniques such as clearing and snagging;
  - Implement livestock rotation and exclusion range management practices;
  - Install 6000 feet of contoured swales;
  - Add fluvial geomorphology and grade stabilization structures;
  - Repair a flood retarding structure; and
  - Install several small rock weirs as grade stabilization structures.

  An educational and outreach component is also present. The project is scheduled for completion in 2002.

- San Pedro Watershed Stewardship Project – The Arizona Association of Conservation Districts received funds to reduce erosion and siltation and enhance riparian conditions and stream channel stability within the San Pedro River and its tributaries. Along with an educational component, the following actions are to be completed in 2002:

  - Install grade stabilization structures and reshape a portion of a tributary channel; and
  - Replant several riparian and flood plain areas with native plant species (range seeding).

- Turbidity Reduction in Aravaipa Creek Through a Watershed Treatment Project – Coronado Resource Conservation and Development was awarded a grant to address sheet and rill erosion in a 60,000 acre drainage area along the headwaters of Aravaipa Creek. Slowing the rate of runoff reaching existing gullies along the creek will keep the gullies from increasing in size. The objective of slowing runoff by improving

vegetation in the lower areas will be met by implementing the following management practices:

- Install fencing to divide the area into smaller pastures with water supplied in the uplands encouraging cattle to utilize these areas;
- Adjust grazing practices so that a higher concentration of cattle will be on each pasture for a shorter length of time. This should improve soil tilth, and allowing seed germination and vegetative regrowth; and
- Use fencing to limit cattle access to the creek. This should result in enhanced riparian vegetation that traps sediment and multiple benefits to wildlife.

A second phase is being planned which will address existing gullies and head cuts. Establishment of a riparian community will play a key role in both phases of erosion treatment in the area through its role in bank stabilization and sediment trapping to reduce turbidity and provide cleaner water to the system.

- Borderlands Storm Water Runoff Control Project – A 2500 acre parcel, between the international border with Mexico and the San Pedro River, will undergo range seeding to increase vegetation and act as a sediment control buffer strip. This should reduce degradation of the Bureau of Land Management's San Pedro Riparian National Conservation Area. The Coronado Resource Conservation and Development is coordinating the implementation of this project with the San Jose Ranch, Hereford Natural Resource Conservation District, the Bureau of Land Management, and the Natural Resource Conservation Service. This project is scheduled for completion in 2003.

- Peppersauce Cave and Cave Water Restoration Project – Peppersauce Cave in Coronado National Forest has permanent pools in three rooms. Two water samples indicated the presence of fecal coliform and *Escherichia coli* contamination. Peppersauce Cave is easily the most visited wild cave in Arizona with the US Forest Service reporting up to 23,000 visits per year. The grant will be used to clean the water, remove the litter and graffiti, create and distribute educational material to reverse the long-standing destruction, erect a kiosk, and encourage current users of the cave to help in these efforts. This project is to be completed in 2003.

Sonoran Desert Conservation Plan -- Pima County developed the Sonoran Desert Conservation Plan in 1999 The objective of the plan is to coordinate short-term actions through long-range planning to ensure that natural and urban environments not only coexist but develop an interdependent relationship where one enhances the other. The action plan is to guide approved public bond investment and preservation actions, establish federal program and funding priorities, and develop our region's preference for the expenditure of state funds to preserve and protect State Trust lands threatened by urbanization. The following projects are associated with this plan:

- Bingham Cienega Riparian Restoration Project -- In the summer of 1998, Pima County and The Nature Conservancy began a three-year project to restore sacaton grasslands, willow forests, and mesquite woodland, at Bingham Cienega Natural Preserve. With help from volunteers and a wide variety of state, federal, and private funding, 50 acres of former farm fields are being transformed to native vegetation with benefits expected for water quality.

- The Bingham Cienega Natural Preserve – This preserve was established when the Pima County Flood Control District acquired lands along the San Pedro River to preserve a natural spring-fed marsh known as the Bingham Cienega. Because of the site's remote location and sensitive environment, the district entered into a long-term agreement with The Nature Conservancy to manage the property. Conservancy volunteers fenced out livestock, and once vegetation began to fill in drainage channels, the marsh began to spread. The District installed a small check dam that has successfully arrested erosion that threatened rapid sedimentation of the marsh.

- San Pedro River Protection Project -- Further protection of the San Pedro River is proposed. In conjunction with the Arizona Chapter of The Nature Conservancy, Pima County will acquire additional land or conservation easements along the San Pedro River from willing sellers. Bonds in the amount of $1 million will be sold to preserve riparian areas near Bingham Cienega and Buehman Canyon. Additional lands may also be set aside. The protection and/or restoration of riparian corridors will serve to slow runoff and reduce excessive sedimentation of the San Pedro River while enhancing habitat for native wildlife.

- Other water course protection projects will be explored when the Pima County Flood Control District works with landowners to protect the flood prone areas from future development through conservation easements and acquisitions. Using bonds approved by voters in 1997, lands along Sabino Creek, Honey Bee Wash, Bear Canyon, Tanque Verde Wash, San Pedro River, and Agua Caliente Wash will be preserved, protecting and/or enhancing water quality. Pima County will encourage the setting aside of state trust land along significant corridors such as Cienega Creek, Mescal Arroyo, Davidson, and Penitas Wash, among others.

Ground Water Studies and Mitigation Projects

Ground Water Quality in the Sierra Vista Subbasin, Arizona – Thirty-nine ground water samples were collected and analyzed in 1996-1997 by the U.S. Geological Survey and ADEQ for the purpose of assessing ground water quality and contaminant source identification within the Sierra Vista subbasin. Review of analytical results indicated that fluoride, iron, manganese, pH, sulfate, and total dissolved solids exceeded state water quality standards. Significant variation was observed in ground water quality with respect to well location, well depth and aquifer type; however, sodium, fluoride, and potassium concentrations were higher in the northern part of the subbasin as compared to the southern. For more information, please contact the ADEQ Ground water Monitoring Unit at (602) 207-4412.

Willcox Basin Baseline Study – The Willcox Basin is 1,911 square miles area delineated by rugged mountains at its fringes and a 29,500 acre playa in its center. The majority of groundwater pumped is for irrigation use. Ground water generally flows from mountain fronts toward the Willcox playa, though heavy irrigation pumping has partially altered this flow and created ground water depressions in intensively farmed areas.

ADEQ conducted a regional ground water quality study of the Willcox Basin in 1999. A total of 58 sites were sampled: 41 randomly-selected sites and 17 targeted sites. Sites were targeted to investigate arsenic and fluoride levels northeast of Willcox and the relationship of parameter concentrations to ground water depth in the Kansas Settlement District. Of the 58 sites sampled, 21 had parameter levels exceeding Arizona's Ground Water Protection Standards (**Figure 77**). Well owners should be particularly concerned about elevated parameter concentrations in the following portions of the basin:

- Fluoride, arsenic, and pH near the Spike E. Hills northeast of Willcox;
- Gross alpha in areas of granitic rock throughout the basin;
- Nitrate, fluoride, and sulfate northwest of Sulphur Hills; and
- Chloride and sulfate west of the Willcox Playa.

Although only limited trend analyses were conducted, parameters in most of the basin do not appear to vary significantly in the short term. However, trends in the Kansas Settlement District indicate that ground water quality seems to be influenced by nitrate and salts carried by excess irrigation water that ultimately recharges the ground water.

Douglas Basin Baseline Study – This basin covers 950 square miles and extends south hydrologically into Mexico; however the international border serves as the southern edge of this basin for reporting purposes. This basin includes Bisbee and Douglas which were historically important copper mining and or processing centers and Elfrida and McNeal which are agriculturally-oriented small towns.

To characterize regional ground water quality, 51 sites were samples: 29 randomly-selected sites and 22 targeted sites. Out of the 51 sites, only three sites exceeded Arizona's Aquifer Protection Standards: arsenic (1 site) beryllium (1 site) and nitrate (1 site).

Nitrate was elevated over 3 mg/L at 21 of the sites, with may indicate impacts from human activities. Areas with the highest nitrate levels included the intensively farmed areas near Elfrida and in the foothills of both the Dragoon and Mule mountains.

Four areas were targeted for more intensive sampling to examine potential effects on ground water quality from various land uses:

- No effects from a landfill near Elfrida were discerned; however, six of the nine targeted wells had elevated nitrate levels. Agricultural activities and septic systems were assumed to be the source of the elevated nitrates;
- Mine tailings appear to be contributing to elevated sulfate in the ground water down gradient of the town of Bisbee;
- Six sites near Douglas showed no impacts from either municipal

activities or slag waste from a copper smelter; and

- A targeted area east of the Bisbee-Douglas Airport unexpectedly showed influences from geothermal activities with very high temperatures, and high levels of total dissolved solids (14,000 mg/L), sulfate (5,020 mg/L), ammonia (1.09 mg/L), and iron (13.9 mg/L).

Although ground water in the basin generally met water quality standards, ADEQ suggests that well owners periodically have their ground water analyzed by a certified laboratory.

Federal and State Superfund Cleanup Sites – Three Superfund and Department of Defense cleanup sites are located in this watershed.

- Klondyke Tailings – In the unincorporated community of Klondyke, this site is located on the north bank of Aravaipa Creek, approximately 4.5 miles upstream of the Aravaipa Canyon Wilderness Area. The site encompasses two piles of mine tailings and adjacent soil, including an area approximately 50 feet into the stream bed of Aravaipa Creek.

  The site was listed on the WQARF registry in 1998 due to various metals left in the tailings. Metals present at concentrations higher than Arizona's Aquifer Protection and Soil Remediation standards include: lead, cadmium, antimony, beryllium, copper, manganese, and arsenic. There is physical evidence that runoff, leaching, and flood erosion of contaminated tailings may be impacting Aravaipa Creek; however, no water quality samples were available for assessment purposes. This project is still in the investigation phase.

- Apache Powder – The Apache Powder Superfund site is located approximately two and a half miles southwest of St. David, Arizona. The site covers approximately nine square miles, including 945 acres of land owned by Apache Nitrogen Products, Inc. (formerly known as the Apache Powder Company). The San Pedro River bounds the eastern side of the site. Contaminants of concern found at this site include: arsenic, fluoride, and nitrate in the perched aquifer; nitrate in the shallow aquifer; arsenic, antimony, barium, beryllium, chromium, lead, manganese, and nitrate in the inactive pond soils and sediments; and two variants of dinitroglycerine and lead in "wash area 3." Additionally, vanadium pentoxide and trinitroglycerine were found in the soils on the site and perchlorate has been found in the perched and shallow aquifers.

- Fort Huachuaca – The Department of Defense has been studying Fort Huachuca, an US Army post located in Sierra Vista. Originally 20 hazardous waste and leaking underground storage tank sites were identified. Of these, fifteen have been cleaned up or require no further action, and only five sites are undergoing remediation or further monitoring.

Watershed Partnerships

The Upper San Pedro Partnership -- This partnership was formed to facilitate and implement sound water resource management and conservation strategies in the Sierra Vista area within the Upper San Pedro River Groundwater Basin. It is a consortium of agencies that own or manage water resources in the Sierra Vista area and agencies that can provide resources to help the partnership accomplish its purpose.

Specifically, the purpose of the Upper San Pedro Partnership is to coordinate and cooperate in the identification, prioritization and implementation of comprehensive policies and projects to assist in meeting water needs in the Sierra Vista sub-watershed of the Upper San Pedro River Basin. Although the general focus of the partnership concentrates on issues pertaining to water quantity, water quality issues are also a component. For more information on the Upper San Pedro Partnership, please contact George Michael at (520) 378-4046.

The Middle San Pedro Partnership – This is a newly formed partnership focused on improving water quality of the Middle San Pedro River though the implementation of Water Quality Improvement Grant projects and cooperation with local land owners. For more information on the Middle San Pedro Partnership, please contact Barbara Clark at (520) 212-2529.

Campomocho-Sacaton Watershed Group – The Campomocho-Sacaton Watershed Group is also a newly formed organization focused on improving water quality of the Middle and Lower San Pedro River through the implementation of Water Quality Improvement Grant projects and cooperation with local landowners. Representation in this watershed group includes the United States Forest Service, Natural Resource Conservation Service, local landowners, Arizona State Land Department, Cochise County, City of Willcox, Arizona Cattlegrowers, Arizona Game and Fish Department, Coronado Resource

Conservation & Development, Willcox-San Simon Conservation District, and the University of Arizona Extension. A principle contact has not been appointed to date.

Cottonwood Canyon Watershed Group – This work group is a newly formed and focused on improving water quality and restoring the flow of Cottonwood Creek though the implementation of Water Quality Improvement Grant projects and cooperation with local landowners. Representation in the Cottonwood Canyon Watershed Group includes the United States Forest Service, Natural Resource Conservation Service, local landowners, Willcox-San Simon Natural Resource Conservation District, Cochise County, Coronado Resource Conservation & Development, Sunglow Guest Ranch, Smith Ranch and the University of Arizona Extension. A principle contact has not been appointed to date.

Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed

SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED CHARACTERISTICS

SIZE	11,096 square miles (10% of the State's land area).
POPULATION BASE	Approximately 933,811 people live in this watershed (estimated from the 2000 census). This is about 18% of the state's population.
LAND OWNERSHIP (Figure 45)	Tribal 39%; Private 22%; State 15%; US Forest Service 10%; Bureau of Land Management 6%; National Wildlife Refuge 4%; Other state and federal 3%; Military lands 1%
LAND USES AND PERMITS (Figure 46)	Most of the population in this watershed is clustered around metropolitan Tucson (approximately 844,000 people), the state's second largest city. However, the combined population of Nogales in Arizona and in Sonora Mexico would be approximately 370,000, with 94% of this population in Mexico. Grazing and irrigated crop production (near stream beds) are the dominant land uses. Some of the agricultural land has been converted to urban use or retired where water rights have been purchased by mining or urban interests. Active mining is scattered across this watershed, but varies with the current market price. In addition, several abandoned mines are located within this watershed, several of which are under investigation as probable contributors of nonpoint source pollution. This watershed includes eight designated wilderness areas, along with National Forests and National Monuments with restricted land uses.
HYDROLOGY AND GEOLOGY	This watershed is a composite of two surface water basins: 1) The Santa Cruz which flows north to the Gila River and 2) The Rio Magdalena and Rio Sonoyta drainage areas which flow south into Mexico. The maximum discharge of the Santa Cruz River is 33,000 cfs (in 1983 near its confluence with the Gila River). In recent years, no flow has been measured during most of the year (USGS 1996). Extensive ground water pumping has eliminated natural perennial flow in most of the Santa Cruz River. Wastewater provides perennial flow below discharges from the cities of Nogales (Arizona and Sonora, Mexico) and Tucson (Brown et al. 1978). Ground water basins and active management areas include: Cienega Creek, San Rafael, San Simon Wash, Tucson AMA, Santa Cruz AMA, Pinal AMA, and West Mexican Drainage. Generally, basin-fill sediments comprise the productive and widely used aquifers. Only minor amounts of ground water are found in the surrounding hardrock mountains in thin alluvial valley deposits and fractured bedrock (ADWR 1994). The primary Hydrologic Province is the Southern Basin and Range, with the southeastern corner of the watershed in Southern Deserts. This area is characterized by broad, gently-sloping alluvial basins, separated by fault block mountains that trend to the north to northwest.
UNIQUE WATERS	Cienega Creek (downstream portion)
HYDROLOGIC PROVINCE(S)	Basin and Range Province.
OTHER STATES, NATIONS, OR TRIBES	This drainage area flows into the Middle Gila Watershed to the North. The headwaters of the Santa Cruz River flow south into Mexico for a distance before returning to the United States. Tohono O'odham, San Xavier, Pascua Yaqui, Ak Chin, and Gila River tribes are significant stakeholders in this watershed, occupying a 39% of the watershed.

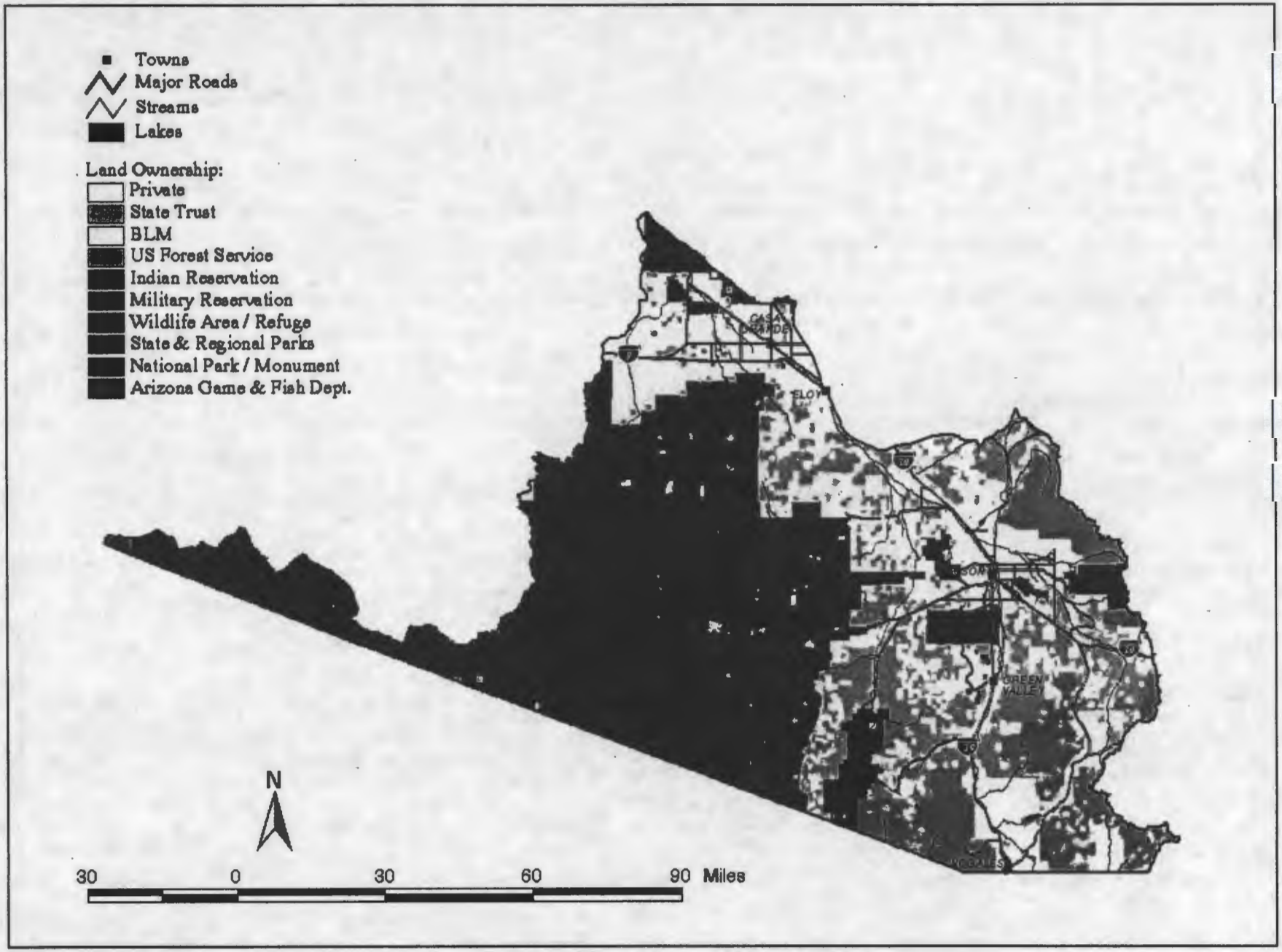

Figure 45. Land Ownership in the Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed

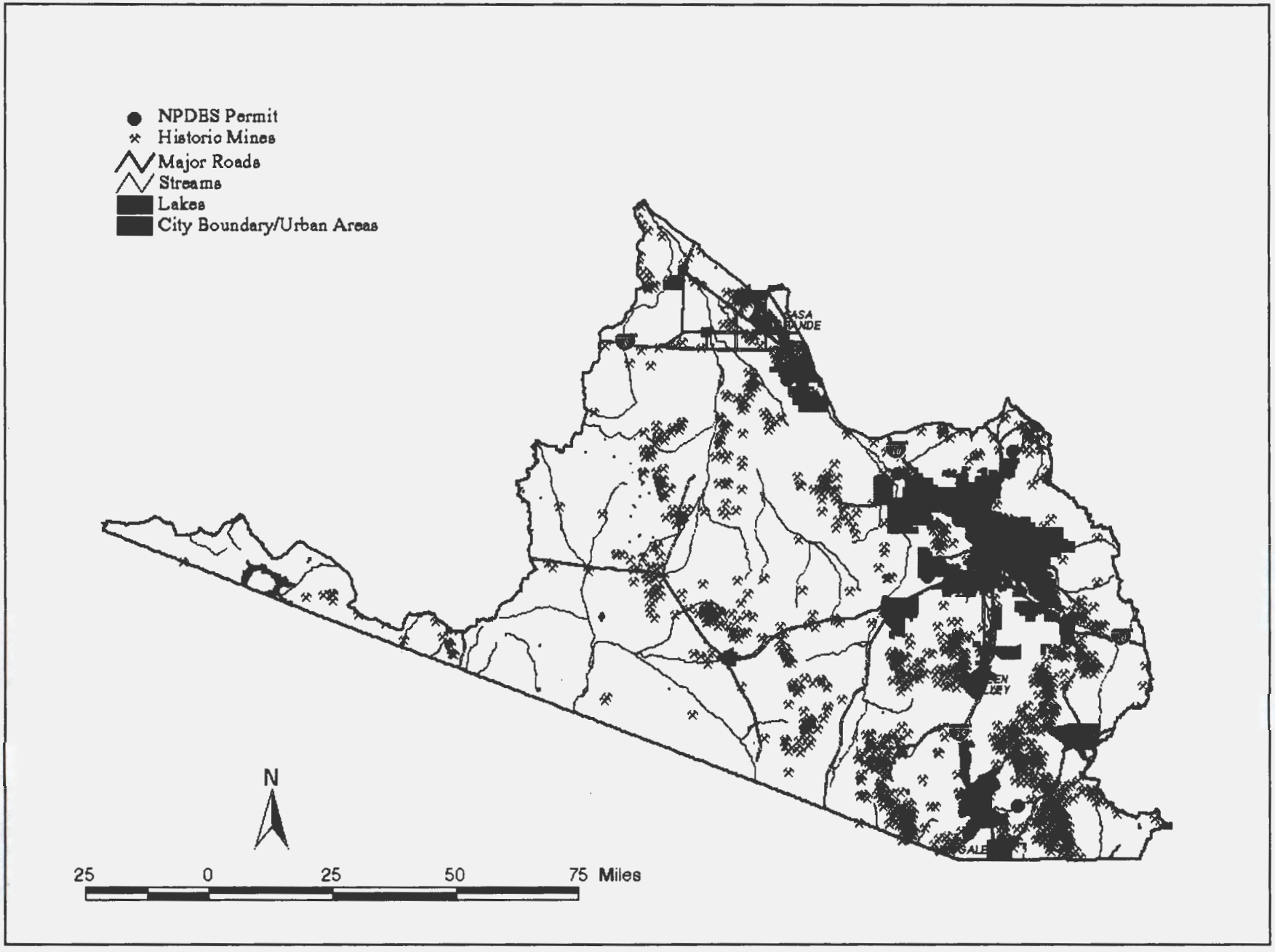

Figure 46. General Land Uses and NPDES Permits in the Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed

Santa Cruz-Rio Magdalena, Rio Sonoyta Watershed Assessment Discussion

Statistical Summary of Surface Water Assessments

Assessments – For the 2002 assessment, 168 miles of streams or washes and 552 acres of lakes were assessed. This assessment does not include the monitoring data generated in 2001 when this was one of two focus watersheds. That data will be included in the next assessment cycle.

Water quality assessment information for the Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed is summarized in the following tables and illustrated in **Figure 47**.

Table 24. Assessments in the Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed – 2002

	STREAMS		LAKES	
	miles	number of segments	acres	number of lakes
ATTAINING	19	1	383	4
INCONCLUSIVE	80	7	0	0
IMPAIRED	69	10	0	0
NOT ATTAINING	0	0	169	2
TOTAL ASSESSED	168	18	552	6

PERENNIAL SURFACE WATERS ASSESSED		STREAMS		LAKES	
		miles	number of segments	acres	number of lakes
	Assessed	102	7	552	6

* Note that streams with significant perennial stretches within the reach assessed were included in the perennial milage although part of the reach may have ephemeral or intermittent flow.

Inconclusive assessments – Surface waters with some monitoring data, but insufficient data to determine if a designated use is attaining or impaired, were added to the new Planning List. By the end of the next watershed monitoring cycle (scheduled in 2006), ADEQ expects to monitor most of these reaches so that all designated uses can be assessed during the following assessment cycle. Other lakes and streams which lack monitoring data will also be monitored depending on resources and priorities.

ADEQ will be working with US Geological Survey and the Arizona Game and Fish Department, so that their future monitoring efforts will better support Arizona's surface water assessments.

Major stressors – When a surface water is listed as impaired or not attaining a designated use, the pollutants or suspected pollutants causing the impairment are identified. The reaches and lakes assessed as impaired or not attaining their uses in this watershed can be divided into four groups based on pollutants and their probable sources:

- Deteriorated municipal wastewater infrastructure in Mexico and the under-designed Nogales International Wastewater Treatment Facility has lead to six stream reaches (51 miles) being assessed as impaired by bacteria, chlorine, and/or cyanide. (See Border Program discussion in Chapter VII of Volume 1.)
- Historic mining activities have cause impairment of four stream reaches (19 miles) due to metals (primarily copper and zinc).
- Mercury contamination of fish tissue has lead to fish consumption advisories and mercury TMDLs at two lakes, Arivaca and Pena Blanca. Historic deposition, air deposition, and mercury cycling in the lakes have contributed to this problem. Further monitoring is being scheduled to determine the effectiveness of TMDL implementation strategies.
- High turbidity is also impairing Nogales Wash.

Watershed assessment map

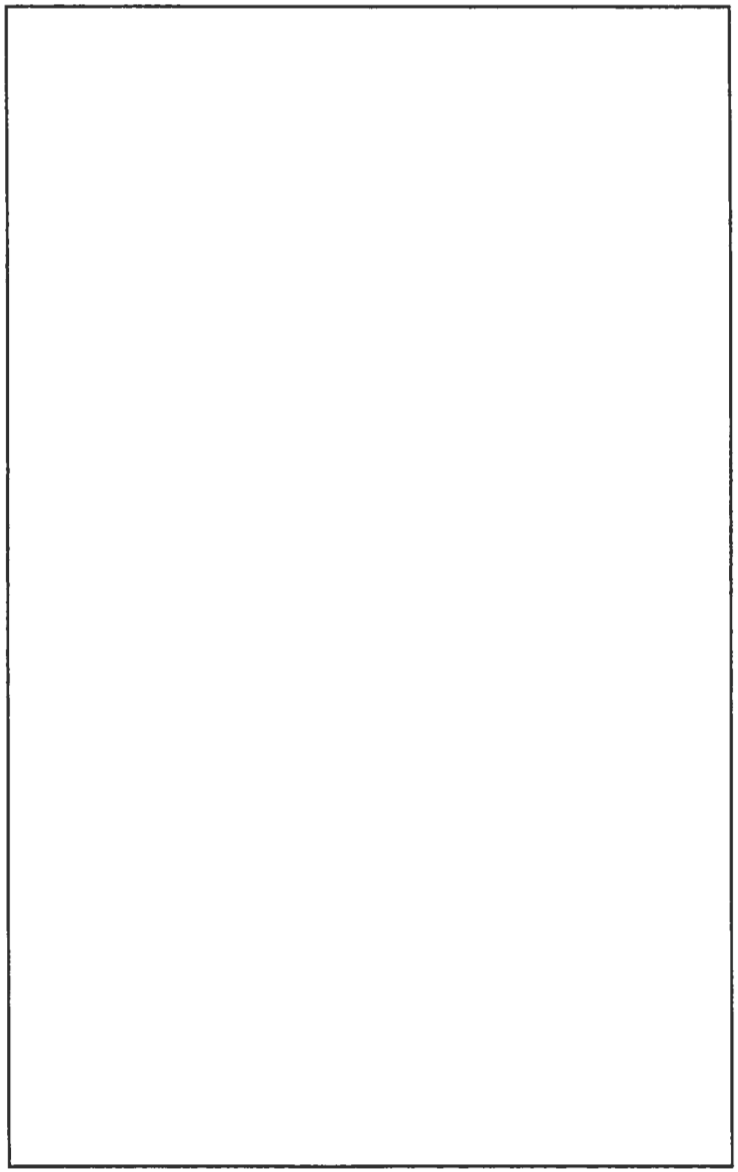

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
STREAM MONITORING DATA								
Alum Gulch headwaters-ephemeral reach AZ15050301-561A A&Ww, FC, FBC, AgL	ADEQ TMDL Monitoring Below World's Fair Mine SCALG004.61 100870	1999 - 1 field, dissolved/total cadmium, copper, zinc 2000 - 1 field, dissolved/total cadmium, copper, zinc	pH SU	6.5 - 9.0 (A&Ww, FBC, AgL)	3.2 - 3.2	2 of 2		Not all core parameters sampled.
			Cadmium (dissolved) µg/L	115 (A&Ww)	170 - 220	2 of 2		
			Cadmium (total) µg/L	41 - FC 50 - AgL 70 - FBC	170 - 290	2 of 2 2 of 2 2 of 2		
			Copper (dissolved) µg/L	65 (A&Ww)	1600 - 2000	2 of 2		
			Copper (total) µg/L	500 (AgL)	1900 - 2100	2 of 2		
			Zinc (dissolved) µg/L	379 (A&Ww)	49,000 -53,000	2 of 2		
			Zinc (total) µg/L	22,000 - FC 25,000 - AgL 42,000 - FBC	45,000-54,000	2 of 2 2 of 2 2 of 2		
	ADEQ TMDL Monitoring Below January Adit SCALG004.82 100317	1998 - 3 field, dissolved/total cadmium, copper, zinc (4) nutrients	Cadmium (total) µg/L	41 - FC 50 - AgL 70 - FBC	27 - 191	2 of 3 2 of 3 2 of 3		Not all core parameters sampled.
			Copper (dissolved) µg/L	56 - 305 (A&Ww)	1600 - 2000	3 of 3		
			Copper (total) µg/L	500 (AgL)	1900 - 2100	3 of 3		
			Zinc (dissolved) µg/L	328 - 1512 (A&Ww)	49,000 -53,000	3 of 3		
			Zinc (total) µg/L	22,000 - FC 25,000 - AgL 42,000 - FBC	7,680 - 54,900	2 of 3 2 of 3 2 of 3		
	ADEQ TMDL Monitoring Below Alum Falls and above World's Fair Mine SCALG004.98 100836	1999 - 1 field, dissolved/total cadmium, copper, zinc	pH SU	6.5 - 9.0 (A&Ww, FBC, AgL)	3.5	1 of 1		Not all core parameters sampled.
			Cadmium(dissolved) µg/L	115 (A&Ww)	160	1 of 1		
			Cadmium (total) µg/L	41 - FC 50 - AgL 70 - FBC	160	1 of 1 1 of 1 1 of 1		

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Copper (dissolved) µg/L	65 (A&Ww)	1500	1 of 1		
			Copper (total) µg/L	500 (AgL)	1400	1 of 1		
			Zinc (dissolved) µg/L	379 (A&Ww)	46,000	1 of 1		
			Zinc (total) µg/L	22,000 - FC 25,000 - AgL 42, 000 - FBC	49,000	1 of 1 1 of 1 1 of 1		
	ADEQ TMDL Monitoring Below Humboldt Canyon, and above Alum Falls SCALG005.30 100837	1999 - 1 field, dissolved/total cadmium, copper, zinc	Cadmium(dissolved) µg/L	115 (A&Ww)	150	1 of 1		Not all core parameters sampled.
			Cadmium (total) µg/L	41 - FC 50 - AgL 70 - FBC	180	1 of 1 1 of 1 1 of 1		
			Copper (dissolved) µg/L	65 (A&Ww)	1200	1 of 1		
			Copper (total) µg/L	500 (AgL)	1200	1 of 1		
			Zinc (dissolved) µg/L	379 (A&Ww)	44,000	1 of 1		
			Zinc (total) µg/L	22,000 - FC 25,000 - AgL	41,000	1 of 1 1 of 1		
			pH SU	6.5 - 9.0 (A&Ww, FBC, AgL)	3.6	1 of 1		
	ADEQ TMDL Monitoring Above Humboldt Canyon SCALG005.58 100838	1999 - 1 field, dissolved/total cadmium, copper, zinc 2000 - 1 field, dissolved/total cadmium, copper, zinc	pH SU	6.5 - 9.0 (A&Ww, FBC, AgL)	4.5 - 5.3	2 of 2		Not all core parameters sampled.
			Cadmium(dissolved) µg/L	115 (A&Ww)	120 - 170	2 of 2		
			Cadmium (total) µg/L	41 - FC 50 - AgL 70 - FBC	140 - 180	2 of 2 2 of 2 2 of 2		
			Copper (dissolved) µg/L	65 (A&Ww)	110 - 400	2 of 2		
			Dissolved oxygen mg/L	6 (90% saturation) (A&Ww)	0.49 - 7.1 (73 - 84% saturation)	1 of 2		Naturally occurring low dissolved oxygen due to very low stream flow (less than 1 cfs); therefore, not included as exceedence in final assessment..

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Zinc (dissolved) µg/L	379 (A&Ww)	39,000 -56,000	2 of 2		Not all core parameters sampled.
			Zinc (total) µg/L	22,000 - FC 25,000 - AgL 42,000 - FBC	42,000-56,000	2 of 2 2 of 2 1 of 2		
	ADEQ TMDL Monitoring Below Trench Camp Mine and above January Adit SCALG005.90 100839	1999 - 1 field, dissolved/total cadmium, copper, zinc	pH SU	6.5 - 9.0 (A&Ww, FBC, AgL)	5.9	1 of 1		Not all core parameters sampled.
			Zinc (dissolved) µg/L	127 (A&Ww)	2500	1 of 1		
	Summary Row A&Ww Impaired FC Inconclusive FBC Inconclusive AgL Inconclusive	1998-1999 10 samples 5 sampling events Missing core parameters	pH SU	6.5 - 9.0 (low) (A&Ww, FBC, AgL)	3.2 - 5.9	7 of 7	Inconclusive	ADEQ collected 10 samples at six sites from 1998 - 2000. Reach is assessed as impaired due to dissolved metals. Reach is also added to the Planning List for total metals, low pH, and missing core parameters.
			Cadmium (dissolved) µg/L	Varies (A&Ww)	56 - 220	6 of 10	Impaired	
			Cadmium (total) µg/L	41 - FC 50 - AgL 70 - FBC	27 - 290	8 of 9 8 of 9 8 of 9	Inconclusive	
			Copper (dissolved) µg/L	Varies (A&Ww)	110 - 2000	9 of 10	Impaired	
			Dissolved oxygen mg/L	6 (90% saturation) (A&Ww)	0.5 - 7.1 (73 - 84% saturation)	1 of 10	Attaining	
			Zinc (dissolved) µg/L	Varies (A&Ww)	2,500 - 56,000	10 of 10	Impaired	
			Zinc (total) µg/L	22,000 - FC 25,000 - AgL 42,000 - FBC	7,680 - 56,000	9 of 9 8 of 9 5 of 9	Inconclusive	
Cienega Creek headwaters-Interstate 10 AZ15050302-006A A&Ww, FC, FBC, AgL	ADEQ Stream Ecosystem Monitoring Below Stevenson Canyon SCCIE012.38 100601	1998 - 1 suite	OK					Missing core parameter: E. coli.
	ADEQ Biocriteria Program Above the Narrows SCCIE012.55 100480	1998 - 1 suite	OK					Missing core parameter: E. coli.
	ADEQ Stream Ecosystem Below Tilted Beds SCCIE011.80 100600	1998 - 1 suite	OK					Missing core parameter: E. coli.

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1998 3 samples 1 sampling event Missing a core parameter	OK				Inconclusive	ADEQ collected samples at 3 sites in 1998. Reach is assessed as "inconclusive" and will be added to Planning List due to a lack of sampling events, seasonal coverage, and no bacteria samples.
Cienega Creek Interstate 10-Del Lago Dam AZ15050302-006B A&Ww, FBC, FC, AgL	ADEQ Stream Ecosystem Monitoring Above Diversion Dam SCCIE000.42 100595	1998 - 1 suite	Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	4.6 (54% saturation)	1 of 1		Naturally occurring low dissolved oxygen dua to very low stream flow (less than 1 cfs) and ground water upwelling. Exceedance not included in final assessment. Missing core parameter: E. coli.
	ADEQ Stream Ecosystem Monitoring At Marsh Station Road SCCIE001.07 100263	1998 - 1 suite	Ok					Missing core parameter: E. coli.
	ADEQ Stream Ecosystem Monitoring Above Davidson Canyon SCCIE001.20 100598	1998 - 1 suite	Dissolved oxygen mg/l	6.0 (90% saturation)	5.4	1 of 1		Naturally occurring low dissolved oxygen due to vary low stream flow (less than 1 cfs) and ground water upwelling. Exceedance not included in final assessment. Missing core parameter: E. coli.
	ADEQ Stream Ecosystem Monitoring Below tilted beds SCCIE003.5 100599	1998 - 1 suite	Ok					Missing core parameter: E. coli.
	Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1998 4 samples 1 sampling event Missing a core parameter	OK				Inconclusive	ADEQ collected samples at 4 sites in 1998. Reach is assessed as "inconclusive" and will be added to the Planning List due to insufficient sampling events, seasonal coverage, and bacteria samples.
Cox Gulch headwaters-Three R Canyon AZ15050301-560 A&Ww, FBC, FC, AgL	ADEQ TMDL Monitoring Below Cox Gulch and canyon leading to European Mine SCCXG000.85 100869	1999 - 1 pH, total/dissolved beryllium, cadmium, copper, zinc 2000 - 1 pH, total/dissolved beryllium, cadmium, copper, zinc	Copper (dissolved) µg/L	49-65 (A&Ww)	8200 - 18,000	2 of 2		
			Cadmium (total) µg/L	41 - FC 70 - FBC	35 - 72	1 of 2 1 of 2		
			Beryllium (total) µg/L	0.21 (FC)	8 - 12	2 of 2		
			pH SU	6.5 - 9.0 (A&ww, FBC)	3.3	1 of 1		
			Zinc (dissolved) µg/L	290-379 (A&Ww)	3200 - 11,000	2 of 2		

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ TMDL Monitoring At European Mine canyon SCCXG001.02 100875	1999 - 1 total/dissolved beryllium, cadmium, copper, zinc	Copper (dissolved) µg/L	44 (A&Ww)	7600	1 of 1		
			Zinc (dissolved) µg/L	264 (A&Ww)	2900	1 of 1		
			Beryllium (total) µg/L	0.21 (FC)	7.4	1 of 1		
	ADEQ TMDL Monitoring Above European Mine canyon SCCXG001.04 100876	1999 - 1 total/dissolved beryllium, cadmium, copper, zinc	Copper (dissolved) µg/L	65 (A&Ww)	8000	1 of 1		
			Zinc (dissolved) µg/L	379 (A&Ww)	5900	1 of 1		
			Beryllium (total) µg/L	0.21 (FC)	7.4	1 of 1		
	Summary Row A&Ww Impaired FC Inconclusive FBC Inconclusive AgL Inconclusive	1999-2000 4 samples 2 sampling events Missing core parameters	Copper (dissolved) µg/L	Varies (A&Ww)	8200 - 18,000	4 of 4	Impaired	ADEQ collected 4 samples at 3 sites from 1999 - 2000. Reach assessed as impaired due to dissolved metals. Reach should also be on the Planning List due to total metals, pH, and missing core parameters.
			Cadmium (total) µg/L	41 - FC 70 - FBC	35 - 72	1 of 4	Inconclusive	
			Beryllium (total) µg/L	0.21 (FC)	7.2 - 12	4 of 4	Inconclusive	
			pH SU	6.5 - 9.0 (low) (A&ww, FBC)	3.3	1 of 4	Inconclusive	
			Zinc (dissolved) µg/L	Varies (A&Ww)	2,900 - 11,000	4 of 4	Impaired	
Harshaw Creek headwaters-ephemeral seg. AZ15050301-025A A&Ww, FC, FBC, AgL	ADEQ TMDL Monitoring Below Trench Camp Mine SCHRS011.56 100319	1998 - 4 nutrients, total/dissolved copper, zinc	Copper (total) µg/L	500 (AgL)	16 - 620	1 of 4		
			Zinc (dissolved) µg/L	varies (A&Ww)	170 - 860	3 of 4		
	ADEQ TMDL Monitoring At lowest observed water SCHRS003.0 100318	1998 - 4 nutrients, total/dissolved copper, zinc	OK					
	ADEQ TMDL Monitoring Below Endless Chain Mine Cyn SCHRS013.63 100848	1999 - 1field, total/dissolved copper, zinc	pH SU	6.5 - 9.0 (A&Ww, FBC, AgL)	4.6	1 of 1		
			Copper (dissolved) µg/L	10 (A&Ww)	62	1 of 1		
			Zinc (dissolved) µg/L	73 (A&Ww)	190	1 of 1		

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Ww Impaired FC Inconclusive FBC Inconclusive AgL Inconclusive	1998-1999 9 samples 5 sampling events Missing core parameters	Copper (total) µg/L	500 (AgL)	16 - 620	1 of 9	Inconclusive	ADEQ collected 9 samples at three sites from 1998 - 1999. Reach is assessed as impaired due to dissolved zinc. Reach should be added to the Planning List due to copper, low pH, and missing core parameters.
			Copper (dissolved) µg/L	Varies (A&Ww)	10 - 62	1 of 9	Inconclusive	
			pH SU	6.5 - 9.0 (low) (A&Ww, FBC, AgL)	4.6 - 6.3	1 of 9	Inconclusive	
			Zinc (dissolved) µg/L	Varies (A&Ww)	42 - 860	4 of 9	Impaired	
Endless Mine Tributary headwaters-Harshaw Creek AZ15050301-888 A&We, PBC	ADEQ TMDL Monitoring above Endless Chain Mine SCHRS000.38 100850	1999 - 1 field, total/dissolved copper & zinc	pH SU	6.5 - 9.0 (A&We, PBC)	6.2	1 of 1		
	ADEQ TMDL Monitoring above mine-impacted area SCHRS000.56 100851	1999 - 2 field, total/dissolved copper & zinc	Dissolved oxygen mg/L	6 (90% saturation) (A&Ww)	5.7 - 6.94 (75 - 94% saturation)	1 of 2		Naturally occurring low dissolved oxygen due to very low stream flow (less than 1 cfs) and ground water upwelling. Exceedance not included in final assessment..
			pH SU	6.5 - 9.0 (A&We, PBC)	5.2 - 6.3	2 of 2		
	Summary Row A&We Inconclusive PBC Inconclusive	1998-1999 3 samples 2 sampling events Missing core parameters	pH SU	6.5 - 9.0 (A&We, PBC)	5.2-6.3	3 of 3	Inconclusive	ADEQ collected 3 samples at 2 sites from 1998 - 1999. Reach should be added to the Planning List due to low pH and missing core parameters.
Humboldt Canyon headwaters-Alum Gulch AZ15050301-340 A&Ww, FBC, FC, AgL	ADEQ TMDL Monitoring Lower Humbolt Canyon at base of falls, above Humbolt Vewwl SCHMC001.27 100840	1999 - 1 field, total/dissolved cadmium, copper, and zinc	pH SU	6.5-9.0 (A&Ww, FBC, AgL)	3.6	1 of 1		
			Copper (dissolved) µg/L	4 (A&Ww)	140	1 of 1		
			Zinc (dissolved) µg/L	30 (A&Ww)	85	1 of 1		
	ADEQ TMDL Monitoring Upper Humboldt Canyon, At Jeep Road SCHMC002.41 100841	1999 - 1 field, total/dissolved cadmium, copper, zinc	pH SU	6.5 - 9.0 (A&Ww, FBC, AgL)	3.3	1 of 1		
			Copper (dissolved) µg/L	7 (A&Ww)	540	1 of 1		
			Copper (total) µg/L	500 (AgL)	550	1 of 1		
			Zinc (dissolved) µg/L	49 (A&Ww)	210	1 of 1		

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1999 2 samples 1 sampling event Missing core parameters	pH SU	6.5 - 9.0 (low) (A&Ww, FBC, AgL)	3.3 - 3.6	2 of 2	Inconclusive	Insufficient sampling events to assess. Add to Planning List.
			Copper (dissolved) µg/L	Varies (A&Ww)	140 - 540	2 of 2	Inconclusive	
			Copper (total) µg/L	500 (AgL)	160 - 550	1 of 2	Inconclusive	
			Zinc (dissolved) µg/L	49 (A&Ww)	55 - 210	2 of 2	Inconclusive	
Nogales and E. Nogales Wash Mexico border-Santa Cruz River AZ15050301-011 A&Ww, PBC	ADEQ Fixed Station Network At West Produce Row Bridge SCNGW001.7 100697	1998 - 1 total chlorine	Chlorine µg/L	11	50	1 of 1		
	ADEQ Fixed Station Network At East Calle Sonora Road SCNGW002.6 100699	1998 - 1 total chlorine	Chlorine µg/L	11	140	1 of 1		
	ADEQ Stream Ecosystem Monitoring Near public works building SCNGW003.15 100206	1998 - 1 suite (no bacterial samples)	Chlorine µg/L	11	140	1 of 1		
	ADEQ Fixed Station Network At West Produce Row Bridge SCNGW003.4 100700	1998 - 1 total chlorine	Chlorine µg/L	11	300	1 of 1		
	ADEQ Fixed Station Network At West Produce Row Bridge SCNGW003.8 100701	1998 - 1 total chlorine	Chlorine µg/L	11	380	1 of 1		
	ADEQ Fixed Station Network At Morley Street Tunnel SCNGW004.23 100251	1996 - 5 suites 1997 - 4 suites 1998 - 5 suites 1999 - 4 suites 2000 - 4 suites	Ammonia mg/l	varies (7.8) (A&Ww)	<0.1 - 9.0	1 of 20		
			Arsenic µg/L	50 (PBC)	<10 - 65	1 of 22		
			Chlorine (free) µg/L	11 (A&Ww)	70 - 2830	21 of 21		
			Dissolved oxygen mg/L	6 (90% saturation) (A&Ww)	4.4 - 9.6 (62%-108% saturation)	3 of 21		
			Fecal coliform CFU/100 ml	4000 (A&Ww, PBC)	0 - >1,000,000	3 of 16		

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Turbidity NTU	50 (A&Ww)	1.51 - 2730	5 of 22		
	Summary Row A&Ww Impaired FBC Impaired	1996 - 2000 27 samples 24 sampling events	Ammonia mg/l	varies (7.8) (A&Ww)	<0.1 - 9.0	1 of 21	Attaining	ADEQ collected 27 samples at 6 sites from 1996 - 2000. Reach assessed as "impaired" due to chlorine, fecal coliform, and turbidity. Deteriorated wastewater treatment infrastructure in Mexico has resulted in increased levels of fecal coliform and, consequently chlorine has been added directly to the stream at high levels to minimize public health concerns.
			Arsenic µg/L	50 (FBC)	<10-65	1 of 23	Attaining	
			Chlorine (free) µg/L	11 (A&Ww)	70 - 2830	26 of 26	Impaired	
			Dissolved oxygen mg/L	6 (90% saturation) (A&Ww)	4.4 - 9.6 (62% - 108% saturation)	3 of 22	Attaining	
			Fecal coliform CFU/100 ml	4000 (A&Ww, FBC)	0 - >1,000,000	3 of 16 4 in 3 years	Impaired	
			Turbidity NTU	50 (A&Ww)	1.51 - 2730	5 of 23	Impaired	
Pena Blanca Canyon Creek Mexico bdr-Pena Blanca Lake AZ15050301-808 A&Ww, FBC, FC, AgL, AgI	AGFD Lakes Program At springs	1997 - 1 suite	OK					Missing core parameters: turbidity, flow, dissolved metals, bacteria, and boron.
	AGFD Lakes Program At International Border	1997 - 1 suite	OK					Missing core parameters: turbidity, flow, dissolved metals, bacteria, and boron
	Summary Row A&Ww Inconclusive FBC Inconclusive FC Inconclusive AgI Inconclusive AgL Inconclusive	1997 2 samples 1 sampling event Missing core parameters	OK				Inconclusive	AGFD collected 2 samples at two sites in 1997. Insufficient parametric coverage and sampling events to assess.
Potrero Creek Interstate19-Santa Cruz River AZ15050301-500B A&Ww, FC, FBC, AgL	ADEQ Fixed Station Network At Santa Cruz River SCPOT000.1 100702	1998 - 1 chlorine	Chlorine µg/l	11 (A&Ww)	80	1 of 1		
	ADEQ Stream Ecosystem Monitoring Upstream of treatment plant SCPOT000.72 100208	1998 - 1 suite	Chlorine µg/l	11 (A&Ww)	80	1 of 1		

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Friends of the Santa Cruz R. At Ruby Road SCPOT001.53 100571	1998 - 6 suites 1997 - 12 suites 1998 - 12 suites 1999 - 12 suites 2000 - 12 suites	Ammonia mg/L	Standards vary with temperature and pH. (A&Ww)	0.03 - 17.9	2 of 50		Missing core parameters: Escherichia coli, inorganics, or metals
			Dissolved oxygen mg/L	6 (90% saturation) (A&Ww)	0.5 - 14	5 of 25		
			Fecal coliform CFU/100 ml	4000 (A&Ww, AGL)	0 - 1,000,000	3 of 15		
			Turbidity NTU	50 (A&Ww)	0.9-220	2 of 27		
	ADEQ Stream Ecosystem Monitoring 1/2 mile N. of Fire Station B SCPOT003.38 100207	1998 - 1 suite	OK					Missing core parameters: bacteria
	ADEQ Fixed Station Network North of Nogales Fire Station SCPOT003.5 100705	1998 - 1 chlorine	Chlorine µg/l	11 (A&Ww)	30	1 of 1		
	Summary Row A&Ww Impaired FC Attaining FBC Attaining AgL Impaired	1996 - 2000 59 samples 57 sampling events	Ammonia mg/L	Vary with pH and temp. (A&Ww)	0.03 - 17.9	2 of 52	Attaining	ADEQ and the Friends of the Santa Cruz River collected 59 samples at 6 sites from 1996 - 2000. Reach assessed as impaired due to fecal coliform. Reach should also be added to the Planning list due to chlorine exceedances, and lack of Escherichia coli samples. Chlorine added in Nogales Wash also affecting this segment (see note above).
			Chlorine µg/l	11 (A&Ww)	40	3 of 3 (1 sampling event)	Inconclusive	
			Dissolved oxygen mg/L	6 (90% saturation) (A&Ww)	0.5 - 14	5 of 27	Attaining	
			Fecal coliform CFU/100 ml	4000 (A&Ww, AgL)	0 - 1,000,000	3 of 17 3 in 2 years	Impaired	
			Turbidity NTU	50 (A&Ww)	0.9-220	2 of 27	Attaining	
Sabino Canyon Creek headwaters-Tanque Verde AZ15050302-014 A&Wc, FC, FBC, DWS, AgI	ADEQ Biocriteria Program Above East Fork Sabino Cyn. SCSAB007.56 100635	1996 - 1 suite	Dissolved oxygen mg/l	7.0 (90% saturation) (A&Wc)	4.0	1 of 1		Missing core parameters: bacteria
	Summary Row	1996 1 sampling event	Dissolved oxygen mg/l	7.0 (90%saturation) (A&Wc)	4.0	1 of 1	Not assessed	Insufficient parametric coverage to assess. Add dissolved oxygen to the Planning List.

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Santa Cruz River Mexican border-Nogales WWTP AZ15050301-010 A&Ww, FC, FBC, DWS, AgI, AgL	Friends of the Santa Cruz R. At Guavai Ranch SCSCR091.90 100246	1996 - 2 suites 1998 - 2 suites 1999 - 1 suite 2000 - 6 suites	Turbidity NTU	50 (A&Ww)	200	1 of 1		Missing core parameters: E coli, inorganics, metals
	ADEQ Fixed Station Network At international boundary SCSCR097.28 100239	1996 - 2 suites 1997 - 2 suites 1998 - 4 suites 1999 - 4 suites 2000 - 4 suites	Dissolved Oxygen mg/L	6 (90% saturation) (A&Ww)	4.3 - 10.1 (64.1 - 126.1% saturation)	2 of 8		Naturally occurring low dissolved oxygen due to very low stream flow (less than 1 cfs); therefore, not included as exceedence in final assessment.
			Escherichia coli CFU/100 ml	580 (FBC)	4 - 10,000	2 of 7		Exceeded single sample maximum standard during flooding and normal conditions.
			Fecal coliform CFU/100 ml	4000 (A&Ww, AgL, AgI, DWS)	8 - 11,200	2 of 7		Exceeded single sample maximum standard during flooding and normal conditions.
			Turbidity NTU	50 (A&Ww)	0.52 - 1854	1 of 8		Flooding conditions present.
			Beryllium µg/L	0.21 (FC)	3.3	1 of 1		6 other berylliums not included because the Method Detection Limit was too high.
	Summary Row A&Ww Impaired FC Attaining FBC Impaired DWS Impaired AgI Impaired AgL Impaired	1996 - 2000 27 sampling events	*Escherichia coli* CFU/100 ml	580 (FBC)	4 - 10,000	2 of 7 2 in 2 years	Impaired	ADEQ and the Friends of the Santa Cruz River collected 27 samples at two sites from 1996 - 2000. Reach was assessed as "impaired" due to bacteria contamination. Reach should also be added to the Planning List due to turbidity and beryllium exceedances.
			Fecal coliform CFU/100 ml	4000 (A&Ww, AgL, AgI, DWS)	8 - 11,200	2 of 10 2 in 2 years	Impaired	
			Turbidity NTU	50 (A&Ww)	0.52 - 1854	2 of 9	Inconclusive	
			Beryllium µg/L	0.21 (FC)	3.3	1 of 1	Inconclusive	
Santa Cruz River Internatl WWTP-Josephine AZ15050301-009 A&Wedw, PBC, AgL	Friends of the Santa Cruz R. At Rio Rico SCSCR087.08 100238	1996 - 11 suites 1997 - 12 suites 1998 - 12 suites 1999 - 12 suites 2000 - 12 suites	Fecal coliform CFU	800 (A&Wedw, PBC, AgL)	0 - 7,700	7 of 37		Missing core parameters: metals
			Turbidity NTU	50 (A&Wedw)	0.4-150 (lab samples)	1 of 30		
	Summary Row A&Wedw Impaired PBC Impaired AgL Impaired	1996 - 2000 59 sampling events Missing core parameters	Fecal coliform CFU	800 (A&Wedw, PBC, AgL)	0 - 7,700	7 of 37	Impaired	The Friends of the Santa Cruz River, under ADEQ's guidance, collected 59 samples from 1996 - 2000. Reach assessed as "impaired" due to fecal coliform. Reach should also be added to the Planning List due to missing core parameters.
			Turbidity NTU	50 (A&Wedw)	0.4-150 (lab samples)	1 of 30	Attaining	

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Santa Cruz River Josephine-Tubac bridge AZ15050301-008A A&Wedw, PBC, AgL	Friends of the Santa Cruz R. At Santa Gertrudis Lane SCSCR080.50 100247	1996 - 11 suites 1997 - 12 suites 1998 - 12 suites 1999 - 12 suites 2000 - 12 suites	Fecal coliform CFU	800 (A&Wedw, PBC, AgL)	0 - 9,200	9 of 37		Missing core parameters: metals
			Turbidity NTU	50 (A&Wedw)	0.5-150 (lab samples)	6 of 31		
	Friends of the Santa Cruz R. At Tubac Bridge SCSCR077.06 100243	1996 - 3 suites 1997 - 3 suites	OK					
	Summary Row A&Wedw Impaired PBC Impaired AgL Impaired	1996 - 2000 59 sampling events 65 samples Missing core parameters	Fecal coliform CFU	800 (A&Wedw, PBC, AgL)	0 - 9,200	9 of 45 9 within 3 years	Impaired	The Friends of the Santa Cruz River, under ADEQ's guidance, collected 89 samples from 1996 - 2000. Reach assessed as "impaired" due to fecal coliform and turbidity. Reach also added to the Planning List due to missing core parameters and investigate the extent of impairment due to turbidity.
			Turbidity	50 (A&Wedw)	0.4-150	6 of 37 6 of 31 at Gertrudis	Impaired	
Santa Cruz River Tubac bridge-Sopori Wash AZ15050301-008B A&We, PBC, AgL	Friends of the Santa Cruz R. North of Chavez Siding Road SCSCR081.34 100244	1996 - 11 suites 1997 - 12 suites 1998 - 12 suites 1999 - 12 suites 2000 - 12 suites	Fecal coliform CFU / 100 ml	800 (A&We, PBC, AgL)	5 - 76,000	6 of 37		Missing core parameters: metals
	Summary Row A&We Impaired PBC Impaired AgL Impaired	1996 - 2000 59 sampling events Missing core parameters	Fecal coliform CFU / 100 ml	800 (A&We, PBC, AgL)	5 - 76,000	6 of 43 6 within 3 years	Impaired	The Friends of the Santa Cruz River, under ADEQ's guidance, collected 43 samples at two sites from 1996 - 2000. Reach assessed as "impaired" due to bacteria contamination.
Santa Cruz River Canada del Oro-Guild Wash AZ15050301-001 A&Wedw, PBC	USGS NAWQA Site #09486500 At Cortaro, AZ SCSCR029.16	1996 - 8 suites 1997 - 4 suites	Dissolved oxygen mg/l	3.0 (3 hours after sunrise to sunset) (A&Wedw)	2.0 - 3.7	6 of 12		Missing core parameters: fecal coliform
	Summary Row A&Wedw Inconclusive PBC Inconclusive	1996 - 1997 12 sampling events Missing core parameters	Dissolved oxygen mg/l	3.0 (3 hours after sunrise to sunset) (A&Wedw)	2.0 - 3.7	6 of 12	Inconclusive	USGS NAWQA Program collected 12 samples from 1996 - 1997. Reach is assessed as "inconclusive"and should be added to the Planning List due to dissolved oxygen exceedances and missing core parameters.

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Sonoita Creek headwaters- 1 km blw Hwy 82 AZ15050301-013A A&We, PBC, AgL	ADEQ TMDL Monitoring At Cottonwood Springs SCSON016.4 100321	1998 - 4 nitrogen, cadmium, copper, lead, zinc, arsenic, beryllium, and mercury.	OK					
	Summary Row A&We Inconclusive PBC Inconclusive AgL Inconclusive	1998 4 sampling events Missing core parameters	OK				Inconclusive	ADEQ collected 4 samples in 1998. Reach assessed as "Inconclusive" due to insufficient parametric coverage.
Sonoita Creek 750 ft below WWTP-Santa Cruz AZ15050301-013C A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Monitoring Above Temporal Mouth SCSON008.5 100320	1998 - 4 nitrogen, cadmium, copper, lead, zinc, arsenic, beryllium, and mercury.	Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	5-7 (64 - 95% saturation)	1 of 4		Naturally occurring low dissolved oxygen due to very low stream flow (less than 1 cfs). Exceedance not included in the final assessment.
	Summary Row A&Ww Inconclusive FC Attaining FBC Inconclusive AgI Inconclusive AgL Inconclusive	1998 4 samples Missing core parameters	OK				Inconclusive	ADEQ collected 4 samples in 1998. Reach assessed as "attaining some uses" and should be added to the Planning List due to missing of core parameters.
Sycamore Canyon headwaters-Mexico border AZ15080200-002 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program Above Penasco Canyon RMSYC002.33 100660	1996 - 1 field, ammonia, cadmium, copper, arsenic, thallium, and mercury	OK					
	Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient parametric coverage and sampling events to assess.
Unnamed trib to Three R Cyn. headwaters-Three R Canyon AZ15050301-xxx A&Ww, FC, FBC	ADEQ TMDL Monitoring U/S from 3R Mine - South trib. (bckgrnd) SCTHC004.50 100852	1999 - 1 field, beryllium cadmium, copper, zinc	pH SU	6.5 - 9.0 (A&Ww, FBC)	3.7	1 of 1		
			Copper (dissolved) µg/L	5 (A&Ww)	380	1 of 1		
			Zinc (dissolved) µg/L	37 (A&Ww)	51	1 of 1		
	Summary Row	1999 1 sampling event	pH SU	6.5 - 9.0 (A&Ww, FBC)	3.7	1 of 1	Not assessed	Insufficient parametric coverage and sampling events to assess. Add to Planning List due to exceedances.
			Copper (dissolved) ug/L	5 (A&Ww)	380	1 of 1		
			Zinc (dissolved) µg/L	37 (A&Ww)	51	1 of 1		

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Three R Canyon headwaters-end of perennial flow AZ15050301-558A A&Ww, FC, FBC	ADEQ TMDL Monitoring At mouth of Cox Gulch SCTH003.03 100322	1998 - 2 field, beryllium, cadmium, copper, zinc	Copper (dissolved) µg/L	varies A&Ww	12,500-36,200	2 of 2		No pH readings.
			Beryllium µg/L	0.21 (FC) 4.0 (FBC)	8	1 of 1		
			Zinc (dissolved µg/L	varies A&Ww	14,800-34,500	2 of 2		
	ADEQ TMDL Monitoring Above 3R Min SCTHC004.67 100874	1999 - 1 field, beryllium cadmium, copper, zinc	Copper (dissolved) µg/L	varies (6) (A&Ww)	1400	1 of 1		
			pH SU	6.5 - 9.0 (A&Ww, FBC)	3.8	1 of 1		
	ADEQ TMDL Monitoring Below uppermost springs in 3R Canyon and 3R Mine SCTHC004.01 100872	1998 - 4 field, beryllium cadmium, copper, zinc 1999 - 1 field, beryllium cadmium, copper, zinc 2000 - 1 field, beryllium cadmium, copper, zinc	Beryllium (total) µg/L	0.21 (FC) 4 (FBC)	2.4- 5.1	2 of 2 (FC) 1 of 6 (FBC)		Other beryllium samples not used because Method Detection Limit was too high.
			Cadmium (total) µg/L	70 (FBC)	40 - 112	1 of 6		
			Cadmium(dissolved) µg/L	Varies (A&Ww)	35 - 143	6 of 6		
			Copper (dissolved) µg/L	Varies (A&Ww)	44,000 - 80,900	6 of 6		
			pH SU	6.5 - 9.0 (A&Ww, FBC)	2.9 - 3.1	5 of 5		
			Zinc (dissolved) µg/L	Varies (A&Ww)	850 - 2790	6 of 6		
	ADEQ TMDL Monitoring Above uppermost springs in 3R Canyon, Below 3R Mine SCTHC004.07 100949	1999 - 1 field, beryllium cadmium, copper, zinc	pH SU	6.5 - 9.0 (A&Ww, FBC)	3.5	1 of 1		
			Copper (dissolved) µg/L	5 (A&Ww)	7200	1 of 1		
			Zinc (dissolved) µg/L	37 (A&Ww)	110	1 of 1		
	Summary Row A&Ww Impaired FC Inconclusive FBC Inconclusive	1999 10 samples 6 sampling events Missing core parameters	Beryllium (total) µg/L	0.21 (FC) 4 (FBC)	<0.5 - 8	3 of 3 (FC) 2 of 10 (FBC)	Inconclusive	ADEQ collected 9 samples at 4 sites in 1999. Reach assessed as "impaired" due to cadmium, copper and zinc. Reach is also added to the Planning List due to beryllium and low pH and missing core parameters.
			Cadmium (total) µg/L	70 (FBC)	40 - 112	1 of 10	Attaining	
			Cadmium (dissolved) µg/L	Varies (A&Ww)	35 - 143	6 of 10	Impaired	

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Copper (dissolved) µg/L	Varies (A&Ww)	380 - 89,000	10 of 10	Impaired	
			pH SU	6.5 - 9.0 (low) (A&Ww, FBC)	2.9 - 3.1	7 of 7	Inconclusive	
			Zinc (dissolved) µg/L	Varies (A&Ww)	850 - 2790	9 of 10	Impaired	
LAKE MONITORING DATA								
Arivaca Lake AZL15050304-0080 A&Ww, FC, FBC, AgI, AgL	EPA TMDL Investigation SCARI	1998 - 2 suites, 2 sediment, 2 fish	pH SU	6.5-9.0 (A&Ww, FBC, AgI, AgL)	6.5 - 9.5	2 of 2		Sediment and fish tissue criteria not available for assessments. Missing core parameters: bacteria
	ADEQ Lakes Program SCARI 100000	1998 - 4 suites, 1 sediment	pH SU	6.5-9.0 (A&Ww, FBC, AgI, AgL)	6.3 - 9.5	1 of 4		
			Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	1.8 - 12.9	1 of 4		
	AGFD Lakes Program SCARI	2000 - 1 suite	OK					
	Summary Row A&Ww Inconclusive FC Not attaining FBC Inconclusive AgI Inconclusive AgL Inconclusive	1998 2 sediment samples 2 fish tissue samples 7 water samples 5 sampling events Missing core parameters	pH (high) SU	6.5-9.0 (A&Ww, FBC, AgI, AgL)	6.3 - 9.5	3 of 7	Inconclusive	ADEQ, AGFD, and EPA collected samples from 1998 - 2000. Lake was assessed as "not attaining" because of a fish consumption advisory for mercury in fish tissue and the completion and EPA approved of a mercury TMDL in 2000. Reach added to Planning List for effectiveness monitoring, exceedances of pH and dissolved oxygen standards, and missing core parameters.
			Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	1.8 - 12.9	1 of 7	Inconclusive	
Kennedy Lake AZL15050301-0720 A&Ww, FC, PBC	ADEQ/AGFD Urban Lakes Study SCKEN 100026	1998 - 10 suites 1999 - 2 suites	pH (high)	6.5-9.0 (A&Ww, PBC)	7.9 - 9.3	1 of 12		Missing core parameters: bacteria
	AGFD Routine Monitoring up to 3 sites SCKEN	1997 - 1 suite	OK					Missing core parameters: depth, metals, bacteria, and turbidity.
	Summary Row A&Ww Attaining FC Attaining PBC Inconclusive	1997 - 1999 13 sampling events Missing bacteria samples	pH (high)	6.5-9.0 (A&Ww, PBC)	7.9 - 9.3	1 of 13	Attaining	ADEQ and AGFD collected 13 samples from 1997 - 1999. Lake is assessed as "attaining some uses" and added to the Planning List due to missing bacteria samples.

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Lakeside Lake AZL15050302-0760 A&Ww, FC, PBC	AGFD Routine Monitoring SCLAK	1997 - 1 suite 1998 - 1 suite	Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	0.9 - 1.7 (18%-176%)	2 of 2		Missing core parameters: metals, bacteria
	ADEQ/AGFD Urban Lake Study SCLAK 100034	1998 - 12 suites 1999 - 2 suites	pH SU	6.5-9.0 (A&Ww, PBC)	7.3 - 9.8	2 of 14		Missing core parameters: bacteria
			Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	1.5 - 17.1 (18%-176%)	2 of 14		
	Summary Row A&Ww Inconclusive FC Attaining PBC Inconclusive	1997 - 1999 16 sampling events Missing core parameters	pH SU	6.5-9.0 (A&Ww, PBC)	7.3 - 9.8	2 of 16	Attaining	ADEQ and AGFD collected 16 samples from 1997 - 1999. Lake is assessed as "attaining some uses" and added to the Planning list due to dissolved oxygen exceedances and missing core parametric coverage.
			Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	1.5 - 17.1 (18%-176%)	4 of 16	Inconclusive	
Parker Canyon Lake AZL15050301-1040 A&Wc, FC, FBC, AgI, AgL	ADEQ Lakes Program SCPAK 100057	1998 - 3 suites	OK					Missing core parameters: bacteria
	Summary Row A&Wc Attaining FC Attaining FBC Inconclusive AgI Attaining AgL Attaining	1998 3 sampling events Missing bacteria samples.	OK				Attaining	ADEQ collected 3 samples in 1998. Lake assessed as "attaining some uses" and added to the Planning List due to missing core parameters.
Patagonia Lake AZL15050301-1050 A&Wc, FC, FBC, DWS, AgI, AgL	EPA TMDL SCPAT	1998 - 1 suite	Dissolved oxygen mg/l	7.0 (90% saturation)	6.5 - 6.7	1 of 1		Missing core parameters: bacteria.
	ADEQ Lakes Program SCPAT	1998 - 3 suites	OK					Missing core parameters: bacteria.
	Summary Row A&Wc Inconclusive FC Attaining FBC Inconclusive DWS Attaining AgI Attaining AgL Attaining	1998 4 samples 3 sampling events	Dissolved oxygen mg/l	7.0 (90% saturation)	6.5 - 6.7	1 of 4	Inconclusive	ADEQ and EPA collected 4 samples in 1998. Lake assessed as "attaining some uses" and added to the Planning List due to missing bacteria samples.
Pena Blanca Lake AZL15050301-1070 A&Wc, FC, FBC, AgI, AgL	EPA TMDL Investigation SCPEN	1998 - 1 suite, sediment	OK					No sediment criteria available for assessments. Missing core parameters: bacteria.
	ADEQ Lakes Program SCPEN 100064	1998 - 3 suites	pH (low) SU	6.5-9.0 (A&Ww, FBC, AgL)	6.1 - 8.2	2 of 3		Missing core parameters: bacteria.

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT								
STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Wc Inconclusive FC Not attaining FBC Inconclusive AgI Attaining AgL Inconclusive	1998 1 sediment sample 4 water samples 4 sampling events Missing core parameters.	pH (low) SU	6.5-9.0 (A&Ww, FBC, AgL)	6.1 - 8.2	2 of 3	Inconclusive	ADEQ and EPA collected 4 samples in 1998. Lake assessed as "not attaining" because of a fish consumption advisory due to mercury in fish tissue, and the completion and approval of a mercury TMDL in 2000. Lake is added to the Planning List for TMDL effectiveness monitoring and due to missing core parameters.
Rose Canyon Lake AZL15050302-1260 A&Wc, FC, FBC, AgI, AgL	ADEQ Lakes Program SCROS 100183	1998 - 1 suite	pH SU	6.5-9.0 (A&Ww, FBC, AgI, AgL)	6.2 - 9.2	1 of 1		
			Turbidity NTU	50 (A&Ww)	4.6 - 19	1 of 1		
	Summary Row	1998 1 sampling event	pH SU	6.5-9.0 (A&Ww, FBC)	6.2 - 9.2	1 of 1	Not assessed	Insufficient data to assess. Lake is added to the Planning List due to pH and turbidity exceedances.
			Turbidity NTU	50 (A&Ww)	4.6 - 19	1 of 1		

Information for Interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from using AZ (for streams) or AZL (for lakes) + Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses", "Agency", and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" -- This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" -- The year and number of water samples is shown. The federal "water year is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
  - "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among samples as many different programs and agencies provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
  - "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
  - If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters
- "Standards Exceeded at this Site per Sampling Event."
  - Although many parameters may be analyzed, only those exceeding a standard are shown.
  - "OK" indicates that no standards were exceeded.
  - The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
  - "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
  - A mean or geometric mean will be shown along with the range of results if applicable to the standard.
- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or " Inconclusive." See assessment criteria in Chapter III of Volume I.

Major ground water stressors -- Monitoring data collected from wells in this watershed between October 1995-October 2000 are summarized in **Table 26** and illustrated in **Figures 48, 49, and 50.**

Overall, nitrates appear to be the most common contaminant affecting ground water quality in the greater Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed. Some probable sources of nitrate in ground water in this watershed would be historic agricultural application of fertilizers and wastewater disposal practices.

Although only three wells exceeded volatile and semi-volatile organic compounds standards, it is important to note that no standards have been established for many of these human-made pollutants, and 12 other wells detected volatile and semi-volatile organic chemicals (VOCs and SVOCs). Contamination sites in the Tucson and Nogales areas are being addressed under the state and federal Superfund programs and through international monitoring programs established with Mexico. Studies related to these sites are discussed in the next section of this watershed report.

Of approximately 89 wells monitored, very few other standards were exceeded (1 radiochemical, 2 fluoride, 1 metal). **Figure 48** illustrates the location of the wells monitored and the wells exceeding standards.

TDS concentrations -- Water quality can be characterized based on concentration of Total Dissolved Solids (TDS). High levels of salinity limits the practical uses of ground water in some areas of this watershed as TDS over 500 mg/L has an off-flavor (23% of wells monitored), and TDS over 1000 mg/L will limit its use for some crops (7% of wells monitored) **(Figure 49 and Table 26).**

No TDS water quality standards apply in this watershed and the elevated levels of TDS do not present a human-health concern for drinking water. The TDS concentration is only used to generally characterize water quality.

Nitrate concentrations -- Water quality can also be characterized by looking at the concentration of nitrates in ground water. In Arizona, natural occurring nitrate concentrations in ground water are generally below 3 mg/L and concentrations above 5 mg/L may indicate potential anthropogenic sources of nitrates. Nitrates were elevated above 5 mg/L in 21 of the 85 wells sampled (25%). As illustrated in **Figure 50**, elevated nitrates are scattered across the watershed.

When nitrate concentrations exceed 10 mg/L, an Arizona's Aquifer Water Quality Standard has been exceeded. This standard was set to protect human health, as water with nitrate greater than 10 mg/L may present a health problem for infants and should not be consumed by nursing mothers. Nine of the wells exceeded this level. As many of the wells sampled are irrigation wells (not used for drinking water), nitrates over 10 mg/L may not represent a human-health concern in this watershed. However, efforts should be made to minimize further contamination of ground water by nitrate.

Table 26. Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed Ground Water Monitoring 1996 - 2000

MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	37		1	3%
	Fluoride	47		2	4%
	Metals/Metaloids	47		0	0%
	Nitrate	47		4	9%
	VOCs + SVOCs*	32	2	0	0%
	Pesticides	33	0	0	0%
TARGETED MONITORING WELLS	Radiochemicals	3		0	0%
	Fluoride	17		0	0%
	Metals/metaloids	42		1	2%
	Nitrate	38		5	13%
	VOCs + SVOCs*	32	10	3	9%
	Pesticides	25	1	0	0%

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
55	43	11	1	0

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
85	64	12	9

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.
*The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.

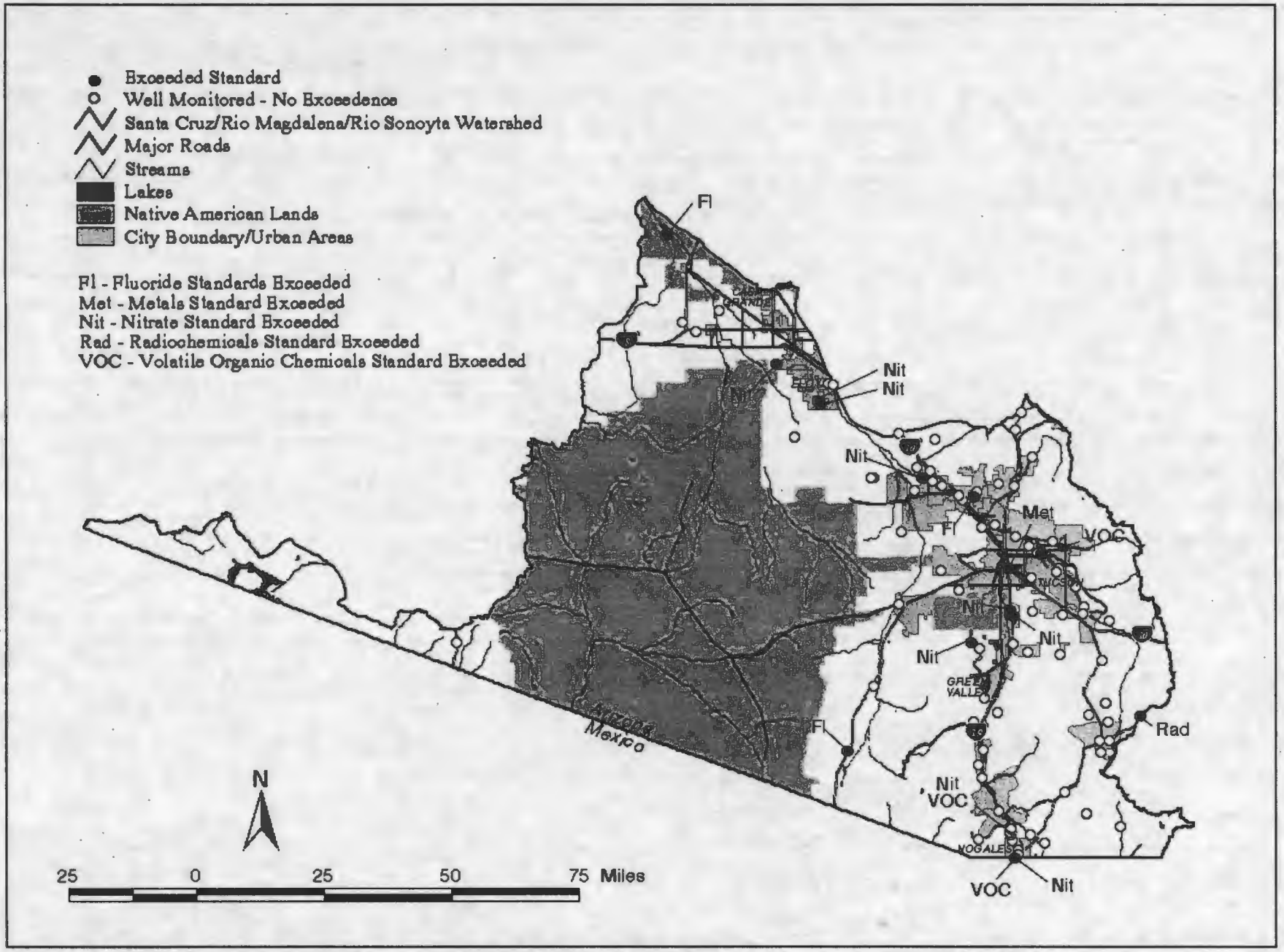

Figure 48. Ground Water Monitoring in the Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed – 1995-2000

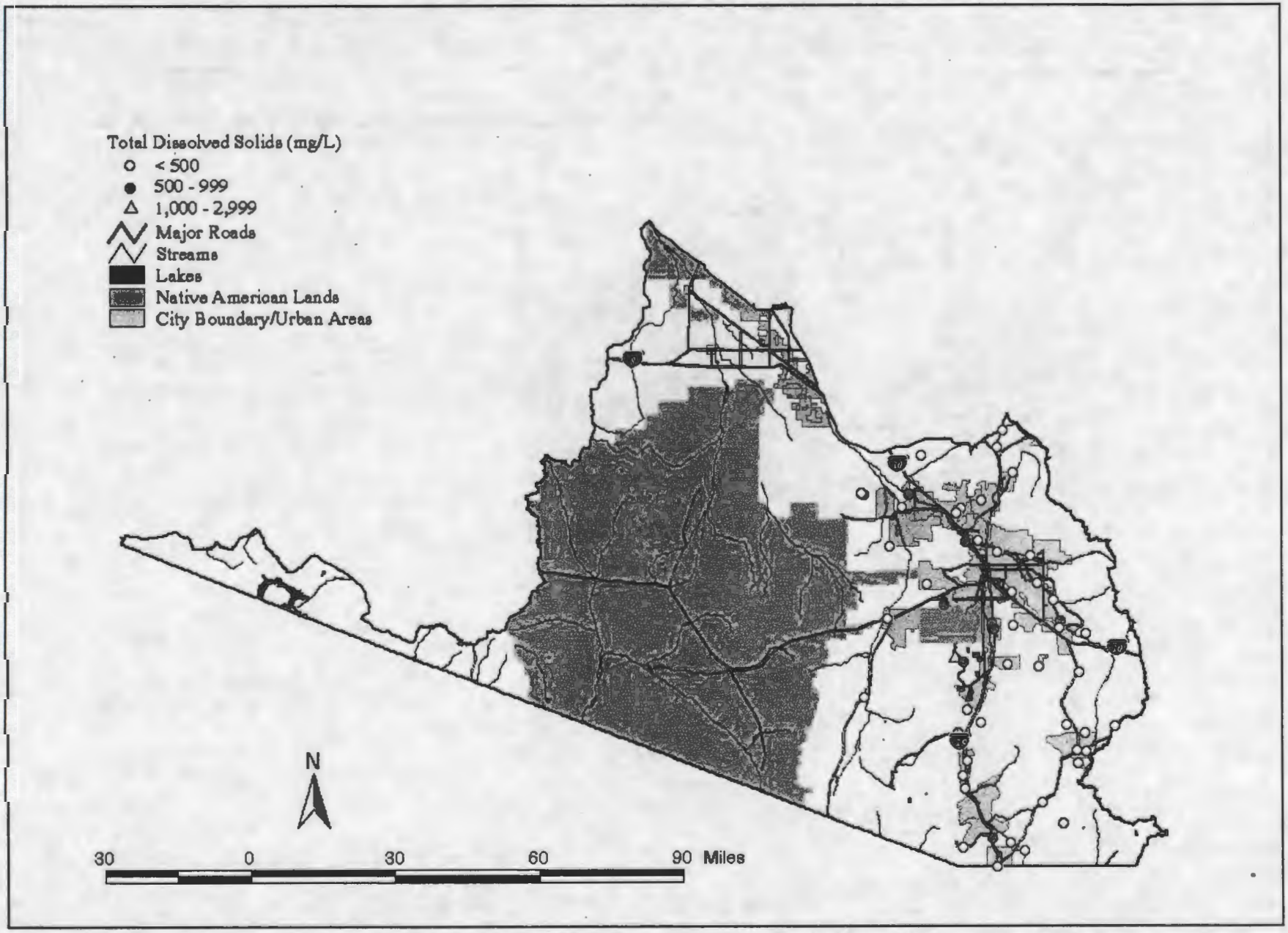

Figure 49. Classification of Ground Water Quality by TDS Concentration – Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed

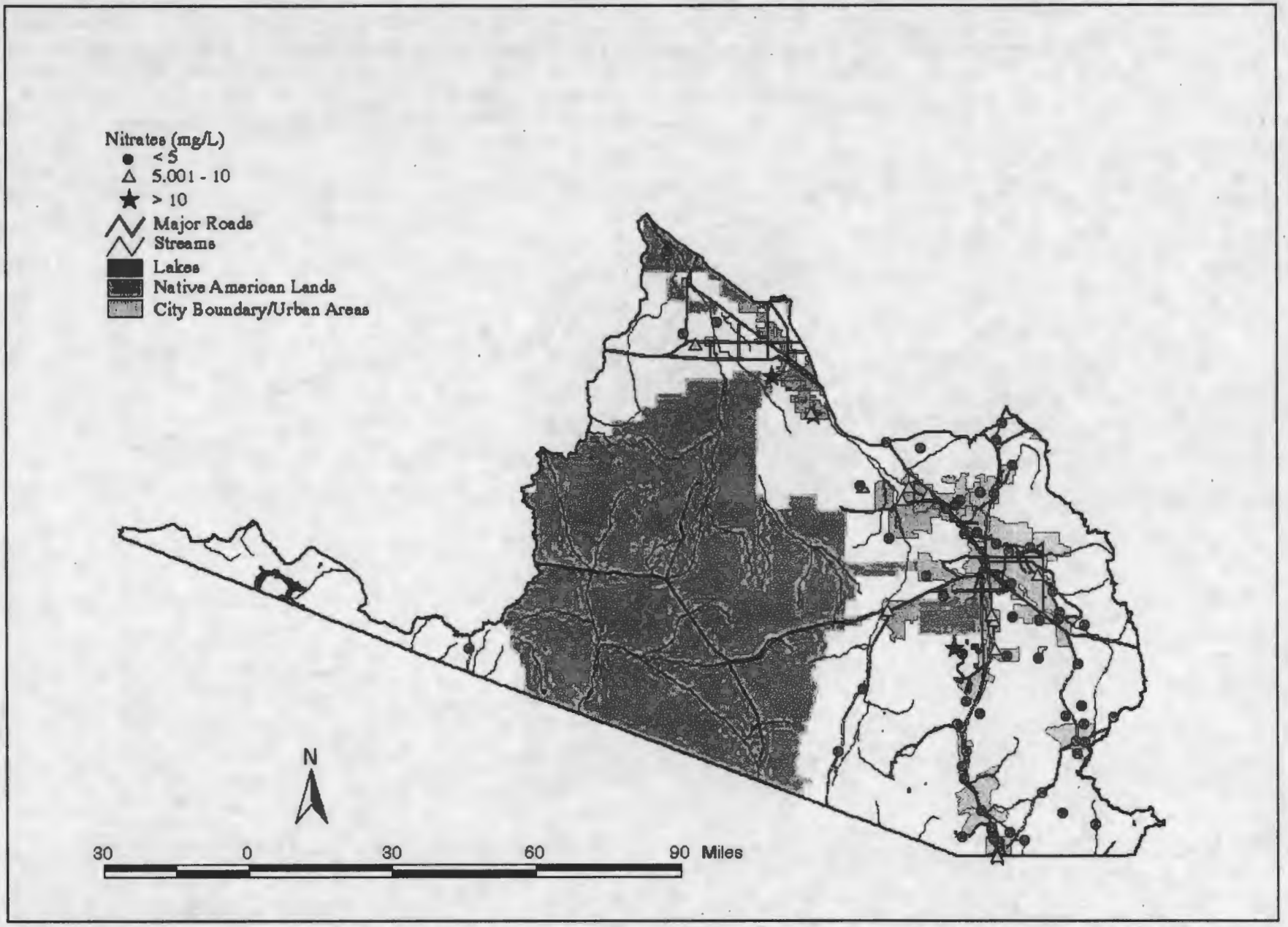

Figure 50. Classification of Ground Water Quality by Nitrate Concentration – Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed

Watershed Studies and Alternative Solutions in the Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed

Surface Water Studies and Mitigation Projects

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed. Watershed partnerships active in this watershed are also mentioned.

Total Maximum Daily Load Analyses – The following TMDL analyses have been completed or are ongoing in this watershed. Further information about the status of these investigations can be obtained by contacting the TMDL Program manager at (602) 207-4468, or at ADEQ's web site: http://www.adeq.state.az.us/environ/water/assess.

- Arivaca Lake Mercury TMDL – Arivaca Lake was identified as impaired because mercury was elevated above EPA's guidance for fish consumption, resulting in a fish consumption advisory being issued. Water samples did not exceed surface water quality standards because mercury readily attaches to soil particles, plants, and fish tissue. Mercury is probably in the water but at a concentration below laboratory detection limits.

  A TMDL for mercury in this lake was written for and approved by the U.S. Environmental Protection Agency in 1999 (Tetra Tech Inc, 1999). The TMDL analysis indicated that Arivaca Lake was receiving mercury simultaneously from multiple sources:

  - Natural deposition from local substrates (mineral deposits);
  - Atmospheric sources; and
  - A dump site (potentially only a minor source of mercury).

  This TMDL estimates that the loading capacity of Arivaca Lake is approximately 155 grams of mercury per year. A 38% reduction in background watershed loading of mercury will be needed to eventually reduce mercury burdens in fish tissue.

  To meet this loading requirement within 10 years, the TMDL included the following provisions:

  - Conduct a followup watershed survey to identify any previously undetected mercury loading sources;
  - Initiate remedial actions if any undetected sources are identified;
  - Implement erosion control best management practices to mitigate further contamination by soils; and
  - Monitor fish tissue for mercury levels to evaluate the effectiveness of any remediation actions.

- Pena Blanca Lake Mercury TMDL – Like Arivaca Lake, Pena Blanca Lake was impaired because of the presence of mercury in fish tissue in excess of EPA's Fish Consumption Guidelines, with a subsequent fish consumption advisory being issued. A TMDL was written for and approved by the U.S. Environmental Protection Agency in 1999 (Tetra Tech Inc, 1999). The TMDL analysis indicated that Pena Blanca Lake was receiving mercury from:

  - Natural deposition from local substrates (mineral deposits);
  - Atmospheric sources; and
  - A contaminated mine tailings pile from St. Patrick Mine (potentially a significant source) on Coronado National Forest property.

  The loading capacity of Pena Blanca Lake is approximately 145 grams of mercury per year. It is anticipated that the remediation of the contaminated mine tailings will reduce mercury loading into the lake to a level sufficient that the fish consumption advisory can be removed within 10 years. Fish tissue analysis will be needed to evaluate the effectiveness of the remediation and to determine if additional actions are necessary.

- Sonoita Basin Draft TMDLs (for Alum Gulch, Harshaw Creek, and Three-R Canyon) -- Draft TMDLs are being generated for three waterbodies in the Sonoita River drainage area: Alum Gulch, Harshaw Creek (Harshaw Wash), and Three-R Canyon. All three investigations are concerned with historic mining sites and acid mine drainage (low pH, high cadmium, copper, and zinc).

Currently, these TMDLs being revised based on public comment and new data provided by the US Geological Survey. Revised reports are to be released for further public comment in July 2002.

- Sonoita Creek Dissolved Oxygen TMDL Study – ADEQ's investigated sources contributing to low dissolved oxygen in Sonoita Creek in 1998 and determined that it was naturally occurring due to ground water upwelling. Ground water is naturally very low in dissolved oxygen. Based on this investigation, ADEQ is recommending that Sonoita Creek be removed from the 303(d) list in 2002.

US Geological Survey NAWQA study – Samples were collected in this watershed as part of the US Geological Survey National Water Quality Assessment Program (NAWQA). This study included sites in the Middle Gila, Santa Cruz-Rio Magdalena-Rio Sonoyta, and Verde watersheds. (See statewide studies discussed in the beginning of Volume II.)

Santa Cruz River Contaminant Study – To investigate the general decline of the endangered Gila topminnow, in 1997 the US Fish and Wildlife Service initiated an assessment of contaminant levels in water, sediment, invertebrates, fish, and birds in the Santa Cruz River (King, et al., 1999). Samples were collected from two sites upstream of the Nogales International Wastewater Treatment Plant and five sites downstream of that plant. Analytical results indicated that elevated chromium was present in both sediment, invertebrates, and fish. The study concluded that un-ionized ammonia was at levels toxic to fish at sites below the treatment plant discharge. Contact the U.S. Fish and Wildlife Service at (602) 242-0210 for more information.

Water Protection Fund Projects – The following projects received Water Protection Funds from the Arizona Department of Water Resources:

- Partnership for Riparian Conservation – The Rincon Institute was awarded two grants to protect riparian areas along Tanque Verde Creek and Rincon Creek. **Phase I.** The Rincon Institute designed and implemented landowner-based strategies to identify and remediate damaged riparian areas and protect healthy ones. **Phase II.** The Rincon Institute will work with private landowners along Tanque Verde Creek and Rincon Creek on three separate projects to be completed in 2002:
  - Design a river-friendly erosion control structure that enhances riparian vegetation reestablishment. This is to stem the loss of property, encourage bank stabilization, and promote aggradation to enhance natural regeneration.
  - Restore riparian vegetation on two acres of former pasture land. Funding will be used for site characterization study, fencing, seed collection and propagation of revegetation materials, irrigation line construction, and site preparation and plantings.
  - Implement a long-term riparian conservation planning and public education project.

To complete Phase I in 1998, Rincon Institute partnered with personnel from the Coronado National Forest, Saguaro National Park, University of Arizona, U.S. Geological Survey, developers and landowners in the watershed.

- Altar Valley Watershed Resources Assessment – Altar Valley Conservation Alliance received a grant to research historic conditions, describe existing conditions, conduct detailed vegetation mapping, and produce community outreach materials for the Altar Valley. The end product was an action plan for the restoration of this sub-watershed, identifying and prioritizing problems, describing feasible remedies, and identifying potential financial means of implement improvements. This project was completed in 2000.

- Madera Canyon - Proctor Vegetation Modification – The Coronado National Forest was awarded a grant to enhance the upland conditions along Madera Canyon. The project goal is to reduce the upland mesquite overstory (with minimal harm to other tree species) and to restore the herbaceous understory to a condition dominated by native perennial grass species. This project recognizes the importance of perennial grasses to soil stability and related in-stream reduction in turbidity. Perennial grasses can also encourage beneficial water retention and rain percolation into the ground, and increase litter development and organic matter levels within the soils.

Little perennial grass understory was at this site due to shading from excessive mesquite overstory. The project removed upland mesquite trees with main stem diameters less than 5 inches, temporary restricted

vehicle use in the area, enforced livestock grazing guidelines, and refurbished a stock pond to draw cattle away from the treatment and regrowth site. The project was completed in 2001.

- Santa Cruz River Headwaters Project – The San Rafael Cattle Company received funds to restore and maintain seven miles of riparian and wetland corridor of the Santa Cruz River headwaters. Fences and water developments are to be constructed to control and manage livestock grazing in the riparian corridor. The project was completed in 2001.

- Oak Tree Gully Stabilization Project – Coronado National Forest was awarded funds to treat 30 headcuts in the Oak Tree Canyon and Empire Gulch (tributaries to Cienega Creek) by reshaping the gullies and decreasing flow velocity and energy. The headcuts appear to be the result of forest service roads and unauthorized vehicular use and a source of turbidity in Cienega Creek. The project was completed in 2001.

- Cienega Creek fencing at Empire Ranch (Empire/Cienega/Empirita fencing project) – Empire Ranch was awarded Watershed Protection Funds to improve livestock management which will benefit the health of the Cienega Creek ecosystem. These improvements included: extending an existing fence, separating sacaton benches, creating a livestock exclosure for monitoring, realigning a degraded road, and creating an alternate wildlife and livestock water source. The project will be completed in 2002.

- Cienega Creek Restoration Project – The US Bureau of Land Management received funds to remove an unused agricultural diversion canal and re-establish flow through the Cienega Creek channel. Disturbed areas were revegetated using plants salvaged at the site. The project was completed in 1999.

- Cienega Creek Restoration Evaluation Project – ADEQ was awarded funds to survey Cienega Creek. Data generated at these sites will be used to better understand erosive processes of dryland streams, a significant problem throughout the state. The project is to be completed in June 2003.

- Lower Cienega Basin geological model refinement project – Arizona Geological Project refined the geologic model for the lower Cienega Basin, located southeast of Tucson. The geologic model is an important component of a computer model used to predict the impact of ground water pumping within a basin on perennial and intermittent stream flow. This research project was completed in 1996.

- Hay Mountain Watershed Rehabilitation – A private owner was awarded funds to install four miles of pipelines and three 10,000 gallon water storage tanks with drinkers, rip and seed native grasses, reshape and recontour two erosion sites, and to install a variety of flood control structures. These watershed improvements are designed to reduce flooding and erosion by increasing infiltration of rainfall into the soil. The project will be completed in 2002.

  The grantee is working with the Natural Resource Conservation Service, the Arizona State Land Department, the Douglas Whitewater Draw Conservation District, Rocky Mountain Elk Foundation, and the Arizona Game and Fish Department to restore and rehabilitate the Hay Mountain sub-watershed (approximately 1000 acres) on the NI Ranch. This sub-watershed is located northwest of Douglas in the southeastern part of the state. The site suffers from over-grazing, with reduction of native grasses and subsequent increases in overland flow. The ephemeral streams have increased width-depth ratios, increased sediment transport and some gullying within the larger arroyos.

- Puertocito Wash Rehabilitation Project on the Buenos Aires National Refuge – The Arizona Conservation Voters Habitat Fund received funds to rehabilitate Puertocito Wash, an eroded ephemeral stream on the Buenos Aires National Refuge. Two gabions were constructed along the stream course and native grasses were re-established. The project was completed in 1999.

- Upper Santa Cruz Watershed Restoration – Lazy J2 Ranch proposes to install fencing and water developments by June 2003 to more evenly distribute livestock grazing impacts throughout the A Bar Draw Allotment in the San Rafael Valley. Nine dirt tanks will be cleaned. Three tanks provide habitat for the endangered Sonoran Tiger Salamander, and would be fitted with sediment traps, and partially fenced to exclude livestock use. The applicant will reconstruct two

corrals to treat livestock without moving them to headquarters, two miles to the west.

According to the Forest Service, the allotment has insufficient vegetative cover and litter accumulation, which results in increased runoff and suspended sediment, and decreased water percolation. This degraded condition is the result of drought and improper grazing management grazing management by the prior permitee.

- Santa Cruz River Park Extension Project – The City of Tucson received funds to create a riparian and upland riparian habitat on a denuded 50 acre lot at the confluence of Irvington Wash and the Santa Cruz River. Seven acres near the wash will be planted with native riparian vegetation, and the remaining 40 acres will be mesquite bosque. Vegetation will be established and supported with tertiary-quality reclaimed wastewater. The city is also to design and build a public access trail system with interpretive signs.

- Atturbury Wash Project – The city of Tucson Water Department was awarded Watershed Protection Funds to establish a sustainable five-acre riparian habitat along a one-half mile tributary of Atturbury Wash within Lincoln Regional Park. Secondary effluent produced at the city's Roger Road Reclaimed Wastewater Treatment Plant will be the source water for this project. The project has three major objectives:

  - Create interconnected wetlands and shallow ponds that will support planted emergent vegetation and create wildlife habitat;
  - Provide information on the capacity of small scale wetlands to reduce nitrogen levels in reclaimed wastewater; and
  - Provide water quality data down gradient of the wetlands.

- Redrock Riparian Improvement Project – Coronado National Forest was awarded funds to improved riparian conditions and expand Gila topminnow habitat in the Redrock Canyon watershed through a series of rangeland improvements. Fencing is to be replaced, an off-stream livestock water source is to be established, a cattle exclosure is to be extended, and a road will be rerouted to allow continued access by motor vehicles outside of the exclosure. The project is to be completed by 2003.

- Rillito Creek Habitat Restoration Project – The City of Tucson is to restore a mesquite bosque along a portion of the Rillito River, and provide recreational and educational opportunities for schools and the public. City staff will guide neighborhood and educational groups in the revegetation and maintenance efforts. This project will use reclaimed water to establish native plants. The project is to be completed in 2003.

- Cortaro Mesquite Bosque Project – Eight (80) acres of riparian habitat is to be established by Pima County Flood Control District on the flood plain terraces in the Town of Marana along the Santa Cruz River. The vegetation is to be irrigated by effluent from two Pima County wastewater treatment plants with supplemental irrigation form tributary flow ponded on the flood plain terraces. This project is to be completed in 2003.

- Protrero Creek Wetland Characterization and Management Plan – EnviroNet, Inc. received funds to determine the source of water that sustains the wetland and riparian area along Potrero Creek, and to determine factors critical to its continuation as a wetland. The project also included a biologic and hydrogeologic evaluation of the area's potential for habitat improvement or habitat replication, and the development of a wetland management plan. The project was completed in 1997.

- Riparian Restoration on the San Xavier Indian Reservation – The San Xavier District of the Tohono O'odham Tribe evaluated various options for restoring riparian areas on their lands. Sites for riparian restoration were chosen base on physical and biological conditions and community preference. A restoration plan was developed. The project was completed in 1999.

- Sabino Creek Riparian Ecosystem Protection Project – In 1998, the Hidden Valley Homeowners Association received Watershed Protection Funds to measure stream flow in Sabino Creek in support of an application for non-consumptive, in-stream flow water right for a reach of Sabino creek. The project area is a privately owned natural riparian park owned by the homeowners association in Tucson.

Sonoran Desert Conservation Plan --The Sonoran Desert Conservation Plan "combines short-term actions to protect and enhance the natural environment with long-range planning to ensure that our natural and urban environments not only coexist but develop an interdependent relationship where one enhances the other. The action plan will guide approved public bond investment and preservation actions, establish federal program and funding priorities, and develop our region's preference for the expenditure of State funds to preserve and protect State Trust lands threatened by urbanization." This plan has lead to the following projects.

- The Cienega Creek Natural Preserve – Nearly 4000 acres along a 12-mile long reach of Cienega Creek has been acquired to preserve one of the region's few remaining perennial streams. Establishment of the preserve in 1986 marked Pima County's first major flood control effort that included riparian habitat preservation. In response to eliminating cattle grazing and off-road vehicle activity, the density of cottonwoods, willows and other trees and shrubs along the stream have increased dramatically and channel erosion has decreased and water quality has decreased.

- Over 23 miles of river parks have been constructed along the Santa Cruz River, Rillito Creek, and Tucson Diversion Channel. These parks are used by thousands of people each week to relax and exercise. The channel bottoms offer one of the few locations for horse use in the growing urban area.

- Pima County Flood Control District Projects -- Other water course protection will be explored when the Pima County Flood Control District works with landowners to protect the flood prone areas from future development through conservation easements and acquisitions. Using bonds approved by voters in 1997, lands along Sabino Creek, Honey Bee Wash, Bear Canyon, Tanque Verde Wash, San Pedro River, and Agua Caliente Wash will be preserved, protecting and/or enhancing water quality. Pima County will encourage the setting aside of state trust land along significant corridors such as Cienega Creek, Mescal Arroyo, Davidson, and Penitas Wash, among others.

- The "Pantano Jungle" Restoration Project -- This project is to re-establish vegetation typical of mesquite woodland and riparian grassland on a site along Pantano Wash (formerly known as the "Jungle") that was cleared for pasture. Native trees and grasses are now being planted to improve the nature of land for wildlife use. Volunteers have installed check dams and other measures to reduce erosion. The project is funded by the U.S. Fish and Wildlife Service and the Arizona Game and Fish Department.

- Rillito Recharge and Habitat Restoration – This project helps restore wetlands and riparian habitat along the south bank of the Rillito river west of Swan Road using reclaimed treated wastewater will be transported from the Roger Road treatment plant. A park will be constructed on the north bank of the river. On-site storm water runoff will also be directed to the wetlands as well as to vegetated areas around them. In addition, Pima County Flood Control Department and the City of Tucson are cooperating on two other projects just upstream: a pilot recharge project and wildlife habitat project (see Water Protection Fund projects discussed above).

- Tucson/Ajo Detention Basin – A 27 acre wetland and riparian habitat is to be constructed in a 120-acre flood control basin located just north of Ajo Way and west of Country Club Road in Tucson. A state-of-the-art stadium, Tucson Electric Park, opened in 1999. This park is irrigated with reclaimed wastewater effluent and storm water captured in the basin.

- The City of Tucson and Pima County have agreed to set aside up to 10,000 acre-feet of treated effluent per year for riparian projects. The effluent can be delivered to sites via the reclaimed water system or other means.

- Agua Caliente Restoration – Habitat for large, self-sustaining populations of native aquatic animals can be recreated at Agua Caliente park. This project is being studied by the US Army Corps of Engineers and Pima County.

- Cienega Creek Stream Flow Restoration Project -- One to five miles of stream flow could be restored by acquiring a one-acre inholding within the Cienega Creek Natural Preserve, transforming what is now an ephemeral stream into a lush riparian area similar to other reaches within the Preserve. The inholding contains two key features, a surface-water diversion dam and a well as a stream flow gaging station used by

the U.S. Geological Survey and Pima County Flood Control District. By acquiring the inholding and the associated water rights, the stream can be made whole again. To do this, the Vail Water Company will need a replacement source of water for its development, either ground water pumped from outside the preserve, effluent, or Central Arizona Project Water (CAP).

- The Rincon Creek Restoration Project – This project is located south of Saguaro National Park's Rincon Mountain Unit. A 600-foot wide riparian-woodland corridor along two miles of the creek is to be restored using a combination of private and public funding. The project is a requirement of Pima County Zoning and Section 404 permits. Most of the native trees and shrubs have been removed and the stream channel has been destabilized due to farming and erosion without the use of visually or physically intrusive structures. Other restoration components include planting, ground water monitoring, and removing livestock. A multi-use trail system within the restore flood plain will provide access to Saguaro National Park.

Water Quality Improvement Grants – ADEQ awarded the following Water Quality Improvement Grants in this watershed.

- Santa Cruz River Sediment Control – This project is to restore 1000 feet of the Santa Cruz River channel that runs through the Santa Fe Ranch. This site is five miles northeast of Nogales. The project is designed to reestablish a healthy riparian corridor that functions to filter sediment and other non-point source pollutants from the river channel while increasing channel stability by installing Kellner jacks for grade stabilization and by revegetation of riparian areas. An educational component includes workshops, brochures, and newsletters. For more information contact the Coronado Resource conservation and Development Area, Inc. at (520) 384-2229.

- The Rillito Wash Recharge and Habitat Restoration Project – This project is to restore wetlands and riparian habitat, whereby improving water quality, along the south bank of the Rillito River west of Swan Road. A park will be constructed on the north bank of the River. Water supply for the project will consist of reclaimed treated wastewater transported from the Roger Road Treatment Plant. On-site stormwater runoff will be directed to the wetlands as well as to vegetated areas around them. In addition, the Pima County Flood Control District is cooperating with the City of Tucson on two other projects upstream -- a pilot recharge project and a wildlife habitat project, both of which will be located on District land east of Swan Road. Cooperators include Pima County, City of Tucson, and the U.S. Army Corps of Engineers.

Ground Water Studies And Mitigation Projects

The Upper Santa Cruz Basin Study – Fifty-eight ground water samples were collected and analyzed in 1998 by the U.S. Geological Survey and ADEQ to assessing ground water quality and identify contaminant sources within the Upper Santa Cruz Basin (Coes, et al., 2000). At least one constituent exceeded state water quality standards in 29% of the samples collected. These constituents included arsenic, fluoride, nitrite (plus nitrate), iron, manganese, pH, sulfate, and dissolved solids.

Factors influencing the regional ground water quality include aquifer depth and proximity to major faults and anthropogenic factors such as recharge from agricultural uses. For more information, please contact the ADEQ Ground Water Monitoring Unit at (602) 207-4412.

Casa Grande Area Study – Situated in Pinal County, the Casa Grande study area encompassed more than 24 square miles. This study area included areas where recent residential development has been concentrated and there is a potential for elevated nitrate levels.

In this study, ADEQ concluded that elevated nitrate levels exist in the northern and southwestern portions of the study area. Potential sources may include malfunctioning septic systems, wastewater discharges, and agricultural runoff. These may also be the sources of elevated levels of chloride, sulfate and total dissolved solids. Elevated levels of arsenic, fluoride and pH may be due to the weathering of sediments derived from igneous rocks. For more information, please contact the ADEQ Ground Water Monitoring Unit at (602) 207-4412.

Hydrogeologic Investigation of Soniota Creek – The Nature Conservancy was awarded Watershed Protection Funds to generate hydrogeologic data from ground water monitoring wells and assist in determining sources of ground water discharge that sustain base flow in the perennial reach of Sonoita Creek. The project looked a ground water movement and sources of base flow in Sonoita Creek and implemented a long-term monitoring program.

Federal and State Superfund Cleanup Sites – Twelve WQARF, National Priority List, and Department of Defense Superfund cleanup sites are located in this watershed.

- Tucson International Airport Area – This 24 square mile area contains seven major project areas including: Air Force Plant 44, Tucson Airport Remediation Project, the Airport Property, the Arizona Air National Guard 162nd facility, Texas Insturments Tucson Corporation, the former West Cap property, and west plume B. Ground water investigations have defined a contamination plume in the regional aquifer consisting mainly of trichloroethene (TCE), with smaller amounts of dichloroethene (DCE), chloroform, and chromium. This plume extends from Air Force Plant 44 north past Irving Road. Ground water pump-and-treat systems and soil vapor extraction systems are among the treatment technologies presently being employed to address contamination of soils and ground water in the area.

- 162 Air National Guard Site – The Arizona Air National Guard 162nd Tactical Fighter Group occupies 84 acres of the Tucson International Airport Area site, along Valencia Road in Tucson. the base has been a training facility for tactical fighter aircraft. The primary ground water contaminant at this site is trichloroethene (TCE). Approximately 110 gallons per minute is being pumped from the ground water, treated, and then reinjected into the ground. A soil vapor extraction system was started on April 3 1997 and shut down on November 29, 1997, after achieving complete soil remediation.

- Raytheon Air Force Plant # 44 – The Raytheon Air Force Plant #44, located in the southern portion of the Tucson International Airport Area, is a federally owned weapons manufacturing facility operated under contract by the Raytheon Corporation (formally Hughes). Historic waste disposal operations at the plant resulted in soil and ground water contamination of metals and volatile organic compounds including trichloroethene (TCE). Remediation activities include large-scale pumping, treating, and reinjecting ground water; soil vapor extraction systems; dual-phase extraction systems; and soil excavation and removal.

- Davis Monthan Air Force Base – The entire Davis Monthan Air Force Base in Tucson is included in the Department of Defense study site. Contamination at the base has been primarily surface soil contamination with petroleum wastes, waste piles of hazardous aluminum dross, and a large volume underground jet fuel leak. Aluminum dross on the base (residue from past melting of obsolete aircraft) has been treated by solidification-stabilization, and has been transported to an off-site landfill.

- Broadway-Pantano site – The Broadway-Pantano site is located in east-central Tucson and includes 130-acre Broadway North Landfill. This site was first put on the WQARF Registry in 1998. Ground water is contaminated by tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride at concentrations exceeding Arizona's aquifer protection standards and drinking water standards. PCE and TCE are volatile solvents commonly used in dry cleaning and metal cleaning operations, and vinyl chloride is often an end product when PCE and TCE chemically decomposed in the environment.

- El Camino del Cerro site – This site in northwest Tucson contains the closed 20-acre El Camino del Cerro Landfill. It was placed on the WQARF Registry in 1998 primarily due to contamination by tetrachloroethene (PCE), trichloroethene (TCE), vinyl chloride, benzene, and methane.

- Los Reales Landfill site – The Los Reales Landfill is an active municipal sanitary landfill in southeast Tucson. The site was placed on the WQARF Registry in 1999 with ground water contamination by volatile organic compounds. Several VOCs have been detected in down-gradient monitoring wells, including: tetrachloroethene (PCE), trichloroethene (TCE), trichlorofluoromethane, dichlorofluoromethane, chloroethane, 1,1-dichloroethene (DCE), methylene chloride, and 1,1-dichloroethane (DCA). Up-gradient wells have not had detectable levels of VOCs.

- Miracle Mile site – The Miracle Mile site in Tucson was placed on the WQARF Registry in 1998 with ground water contamination by at least seven different volatile organic chemicals. The predominant contaminants are trichloroethene (TCE), tetrachloroethene (PCE), dichlorodifluoromethane (Freon 12), trichlorofluoromethane (Freon 11), 1,1-dichloroethene (DCE), and methyl tertiary butyl ether (MTBE). Benzene and chromium have each exceeded Arizona's aquifer

protection standards in at least one well at the site.

- Park-Euclid site – This site in Tucson includes facilities on South Park, where several companies conducted laundry and dry-cleaning operations since the late 1930s. The site was placed on the WQARF Registry in 1999. Ground water contamination is a combination of diesel free product and volatile organic compounds, including tetrachloroethene (PCE), trichloroethene (TCE), and 1,1-dichloroethene (DCE).

- Shannon Road - Rillito Creek site – This Tucson site extends approximately one quarter mile north and south of Rillito Creek. This site was placed on the WQARF Registry in 1999 with ground water contamination by tetrachloroethene (PCE), trichloroethene (TCE). As remedial investigations proceed, the extent of contamination will be further defined. Other VOCs have been detected at this site but below regulatory limits.

- Silverbell Jail Annex Landfill – This site was placed on the WQARF Registry in 1999. Investigations have discovered a ground water plume consisting of solvents tetrachloroethene (PCE), trichloroethene (TCE). Other VOCs routinely detected in monitoring wells include vinyl chloride, dichlorodifluoromethane, trichlorofluoromethane, methylene chloride, and cis-1,2-dichloroethene (DCE).

Watershed Partnerships

Friends of the Santa Cruz River – The Friends of the Santa Cruz River was established by community members to "preserve and enhance water quality and perennial flow of the upper Santa Cruz River." Member volunteers have helped ADEQ collect fecal coliform and chlorine samples in the upper Santa Cruz River. The data generated was used in making assessments in this report

For information about meetings and activities, contact Mark Larkin at (520) 398-9093.

Upper Gila (Safford-San Carlos-Duncan) Watershed 2002 Assessment

UPPER GILA (Safford-San Carlos-Duncan) WATERSHED CHARACTERISTICS						
SIZE	7,354 square miles (6% of the state's land area).					
POPULATION BASE	Approximately 51,500 people live in this watershed (estimated from the 2000 census). This is about 1% of the state's population.					
LAND OWNERSHIP (Figure 51)	Tribal	28%	US Forest Service	23%	Private	9%
	Bureau of Land Management	22%	State	14%	Other state and federal	4%
LAND USES AND PERMITS (Figure 52)	Safford is the largest community in this watershed. In the Safford area, irrigated agriculture uses a high percentage of Gila River flow. Outside the Safford area, land use is primarily grazing and recreation with a minor amount of silviculture in the national forests. A major mining facility is located in the Clifton-Morenci area along the San Francisco River. In 1990, Congress passed the Arizona Desert Wilderness Act that designated the Gila Box Riparian National Conservation Area, and directed the BLM to conserve, protect, and enhance the riparian and wetland areas within the conservation area. There are also five designated Wilderness Areas and a Wilderness Study Area on Mount Graham that have restricted land uses.					
HYDROLOGY AND GEOLOGY	This watershed is defined by the Gila River drainage area from New Mexico to Coolidge Dam (San Carlos Reservoir). Perennial flow is limited to the Gila River above Safford, the San Francisco sub-watershed, Eagle Creek, the lower portion of Bonita Creek, a portion of the San Carlos River, and short stretches of tributaries on Mount Graham and Chiricahua Mountains. (Brown et al. 1978). The flow in the Gila River above the Safford Valley ranges from 11 cfs (in 1956) to 132,000 cfs (in 1983), with an annual mean of 477 cfs (USGS 1996). Ground water basins include: Bonita Creek, Duncan Valley, Morenci, and Safford. The Safford and Duncan ground water basins are large trough-like depressions formed by elongated mountain ranges composed of gneiss, schist, granite, volcanic material, and sedimentary rocks. These mountains rim a broad, alluvial-filled valley composed of the erosional remnants of these mountains. This alluvial fill constitutes the major aquifer in the Safford and Duncan Basins. Average discharge from wells is 1,000 gallons per minute. Ground water levels and movement in these two basins are strongly influenced by the Gila River (ADWR 1994). The Bonita Creek and Morenci ground water basins, within the Central Highlands province, have limited ground water resources. Most wells tap alluvial deposits along the major stream courses while the surrounding hardrock areas produce limited ground water quantities (ADWR 1994). The Hydrological Province is primarily the Basin and Range Province, but the northern third falls within the Central Highlands Province.					
UNIQUE WATERS	Designated Unique Waters in 2001: Bonita Creek, Cave Creek, and the South Fork of Cave Creek.					
ECOREGIONS	Primarily Southern Deserts. Northern edge in Arizona-New Mexico Mountains.					
OTHER STATES, NATIONS, OR TRIBES	San Carlos Apache Indian tribe is a significant stakeholder in this watershed with 58% of the watershed on tribal lands. Approximately 5,000 square miles of this watershed's drainage area extends into New Mexico.					

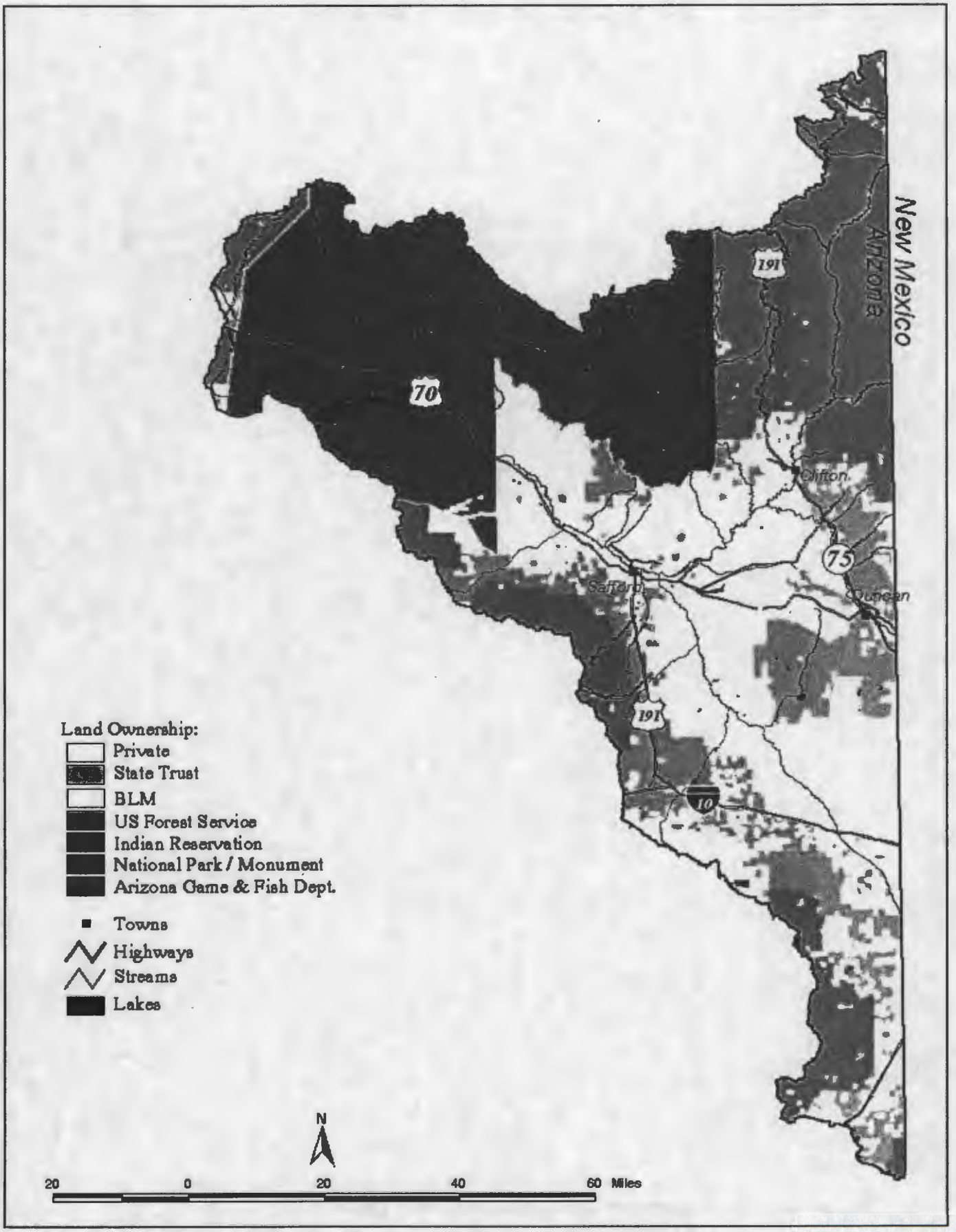

Figure 51. Land Ownership in the Upper Gila (San Carlos-Duncan-Safford) Watershed

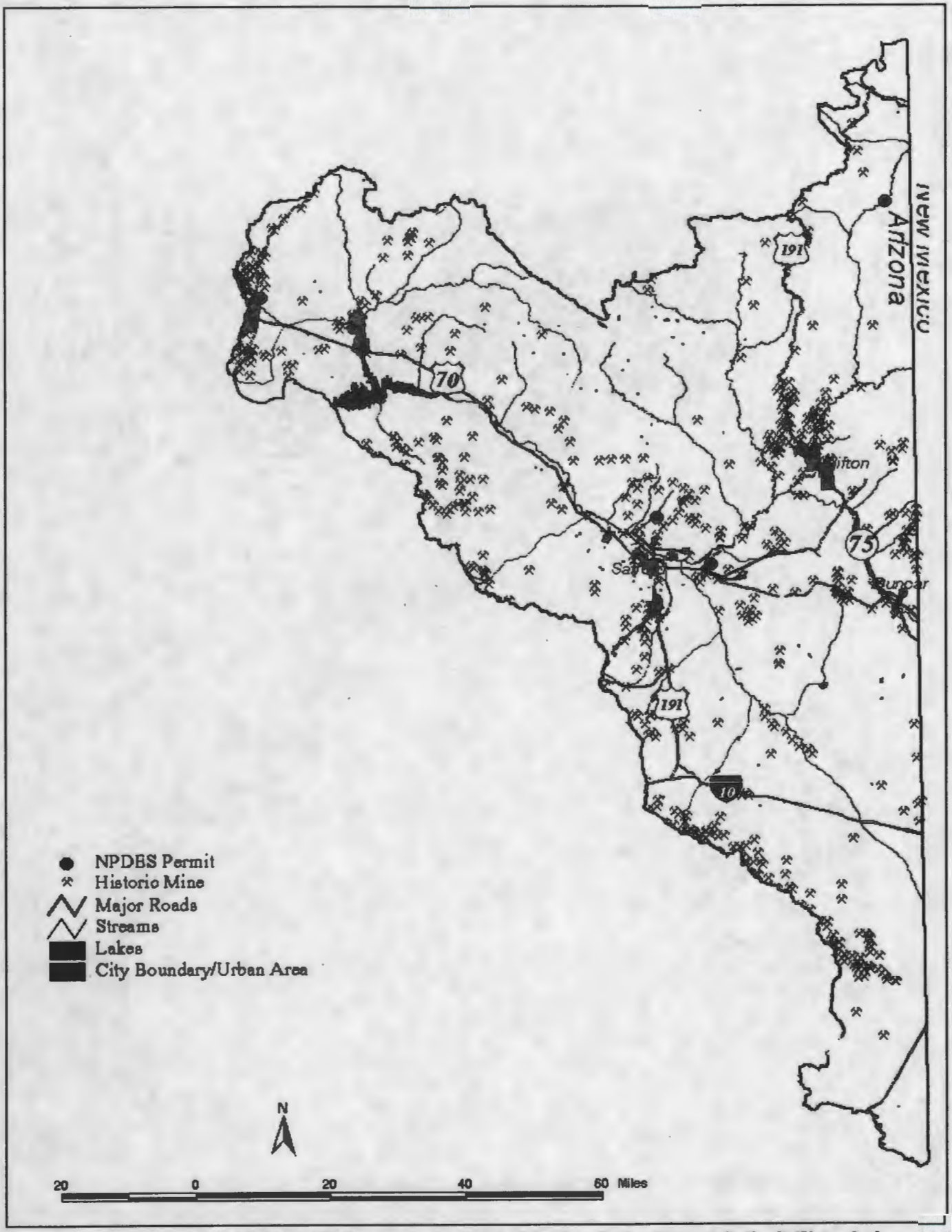

Figure 52. General Land Use and NPDES Permits in the Upper Gila (San Carlos-Duncan-Safford) Watershed

Upper Gila Watershed Assessment Discussion

Statistical Summary of Surface Water Assessments

Assessments – For the 2002 assessment, 320 stream miles and 153 lake acres were assessed. This assessment reflects data collected in 2000 when this was one of two focus watersheds.

Water quality assessment information for the Upper Gila Watershed is summarized in the following tables and illustrated on **Figure 53**.

Table 27. Assessments in the Upper Gila (Safford-San Carlos-Duncan) Watershed – 2002

	STREAMS		LAKES	
	miles	number of segments	acres	number of lakes
ATTAINING	252	17	33	2
INCONCLUSIVE	49	3	0	0
IMPAIRED	19	2	0	0
NOT ATTAINING	0	0	120	1
TOTAL ASSESSED	320	22	153	3

PERENNIAL SURFACE WATERS ASSESSED		STREAMS		LAKES	
		miles	number of segments	acres	number of lakes
	Assessed	320	22	153	3

* Note that streams with significant perennial stretches within the reach assessed were included in the perennial milage although part of the reach may have ephemeral or intermittent flow.

Inconclusive assessments – Surface waters with some monitoring data, but insufficient data to determine if a designated use is attaining or impaired, were added to the new Planning List. By the end of the next watershed monitoring cycle (scheduled in 2005), ADEQ expects to monitor most of these reaches so that all designated uses can be assessed during the following assessment cycle. Other lakes and streams which lack monitoring data will also be monitored depending on resources and priorities.

ADEQ will be working with US Geological Survey and the Arizona Game and Fish Department, so that their future monitoring efforts will better support Arizona's surface water assessments.

Major stressors – When a surface water is listed as impaired or not attaining a designated use, the pollutants or suspected pollutants causing the impairment are identified. In this watershed, two reaches were impaired by turbidity.

A nutrient TMDL was completed and approved by EPA for Luna Lake in 2000. Currently, ADEQ is scheduling monitoring to evaluate the effectiveness of TMDL implementation strategies.

Watershed map
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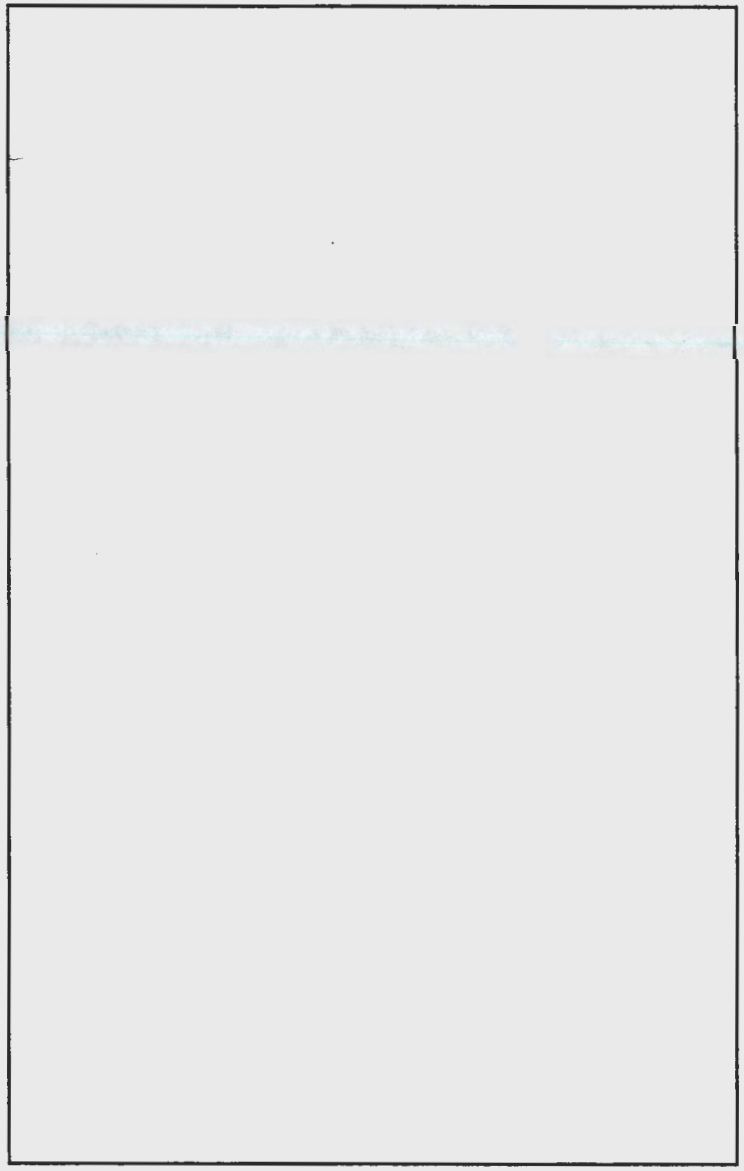

TABLE 28. UPPER GILA (Safford-San Carlos-Duncan) WATERSHED - MONITORING DATA - 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
STREAM MONITORING DATA								
Ash Creek headwaters-Gila River AZ15040005-040 A&Wc, FC, FBC, AgL	ADEQ Fixed Station Network @ Forest Road #307 UGA1H008.62 100830	2000 - 3 suites	Dissolved oxygen mg/L	7.0 90% Saturation (A&Ww)	6.8-8.2 68-108%	1 of 3		
	Summary Row A&Wc Inconclusive FC Attaining FBC Attaining AgL Attaining	2000 3 sampling events	Dissolved oxygen mg/L	7.0 90% Saturation (A&Ww)	6.8-8.2 68-108%	1 of 3	Inconclusive	ADEQ collect 3 samples in 2000. Reach assessed as "attaining some uses. Need more samples to determine if dissolved oxygen is impairing uses.
Blue River New Mexico -KP Creek AZ15040004-026 A&Wc, FC, FBC, AgI, AgL	ADEQ Biocriteria & Fixed Station Below Jackson Box (upper) UGBLR033.04 100419	1996 - 1 suite 2000 - 3 suites, 1 field	OK					
	Summary Row A&Wc Attaining FC Attaining FBC Attaining AgI Attaining AgL Attaining	1996-2000 4 sampling events	OK				Attaining	ADEQ collected 4 samples in 1996-2000. Reach assessed as "attaining all uses."
Blue River KP Creek-San Francisco River AZ15040004-025 A&Wc, FC, FBC, AgI, AgL	ADEQ Fixed Station Network @ Juan Miller Road UGBLR005.68 100398	1996 - 6 suites 1999 - 5 suites 2000 - 4 suites	Dissolved oxygen mg/L	7.0 (A&Wc) 90% Saturation	6.3-9.6 88-115%	1 of 14		
			Turbidity NTU	10 (A&Wc)	<1-22	2 of 14		
	ADEQ Biocriteria program Above Fritz Ranch (lower) UGBLR008.07 100420	1996 - 1 suite	OK					
	ADEQ Fixed Station Network Below K P Creek UGBLR021.95 100835	2000 - 4 suites	OK					
	AGFD @ Stacey Crossing UGBLR	1997 - 1 suite	OK					
	Summary Row A&Wc Attaining FC Attaining FBC Attaining AgI Attaining AgL Attaining	1996-2000 21 samples 17 sampling events	Dissolved oxygen mg/L	7.0 (A&Wc) 90% Saturation	6.3-9.6 88-115%	1 of 16	Attaining	ADEQ collected 20 samples at three sites and AGFD collected one sample in 1996-2000. Reach assessed as "attaining all uses."
			Turbidity NTU	10 (A&Wc)	<1-22	2 of 16	Attaining	

TABLE 28. UPPER GILA (Safford-San Carlos-Duncan) WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Bonita Creek Park Creek-Gila River AZ15040005-030 A&Ww, FC, FBC, DWS, AgL Unique Waters	ADEQ Fixed Station and TMDL Above Gila River UGBON000.20 100185	1997 - 1 suite, 5 metals 1998 - 1 suite 2000 - 4 suites	OK					
	ADEQ Stream Ecosystem Mon. Below infiltration gallery UGBON003.2 100186	1997 - 1 suite	OK					
	ADEQ Biocriteria program Above Gila River UGBON004.82 100421	1997 - 1 suite	OK					
	ADEQ Stream Ecosystem Mon. Below Lines Canyon UGBON007.9 100187	1997 - 1 suite	OK					
	ADEQ Fixed Station & Stream Ecosystem Monitoring Below Indian lands UGBON011.31 100188	1997 - 1 suite 2000 - 4 suites	OK					
	Summary Row A&Ww Attaining FC Attaining FBC Attaining DWS Attaining AgL Attaining	1997-2000 19 samples 6 sampling events	OK				Attaining	ADEQ collected a total of 19 samples at 5 sites in 1997-2000. Reach assessed as "attaining all uses."
Campbell Blue Creek headwaters-Blue River AZ15040004-026 A&Wc, FC, FBC, AgL	ADEQ Biocriteria & Fixed Station Above K E Canyon UGCMB002.16 100522	1998 - 1 suite 2000 - 4 suites	OK					
	Summary Row A&Wc Attaining FC Attaining FBC Attaining AgL Attaining	1998-2000 5 sampling events	OK				Attaining	ADEQ collected 5 samples in 1998-2000. Reach assessed as "attaining all uses."
Cave Creek headwaters-USFS boundary AZ15040006-852A A&Wc, FC, FBC, AgI, AgL Unique Waters	ADEQ Unique Waters & Fixed Station Below ranger station UGCAV006.55 100937	1997 - 1 suite 1998 - 1 suite 1999 - 1 suite 2000 - 3 suites	Turbidity NTU	10 (A&Wc)	<1-64	1 of 6		Exceedance occurred during very high flow (normally <1 cfs, flow at 65 cfs). Not included in final assessment.

TABLE 28. UPPER GILA (Safford-San Carlos-Duncan) WATERSHED - MONITORING DATA - 2002 ASSESSMENT								
STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Unique Waters & Fixed Station Below North Fork Cave Creek UGCAV007.64 100933	1997 - 1 suite 1999 - 1 suite 2000 - 4 suites	Turbidity NTU	10 (A&Wc)	<1-15	1 of 6		Exceedance occurred during very high flow (normally < 1 cfs, flow at 48 cfs).
	ADEQ Unique Waters Program Above SW Research Station UGCAV008.49 11108	1997 - 1 suite 1998 - 1 suite 1999 - 1 suite	OK					
	ADEQ Unique Waters Program Above septic systems for summer homes UGCAV008.92 101107	1997 - 1 suite 1999 - 1 suite	OK					
	ADEQ Unique Waters Program Above Herb Martyr Campground UGCAV016.3 101108	1997 - 1 suite 1998 - 1 suite 1999 - 1 suite	OK					
	Summary Row A&Wc Attaining FC Attaining FBC Attaining AgI Attaining AgL Attaining UW Attaining	1997-2000 20 samples 7 sampling events	Turbidity NTU	10 (A&Wc)	<1-64	2 of 20	Attaining	ADEQ collected 20 samples at 5sites in 1997-2000. Reach assessed as "attaining all uses."
Cave Creek USFS boundary-New Mexico AZ15040006-852B A&Wc, FC, FBC, AgI, AgL	ADEQ Unique Waters Program Above South Fork of Cave Creek UGCAV007.70 101105	1997 - 1 suite 1998 - 1 suite 1999 - 1 suite	OK					
	ADEQ Unique Waters Program Below South Fork of Cave Creek UGCAV007.46 11104	1997 - 1 suite 1998 - 1 suite 1999 - 1 suite	OK					
	Summary Row A&Wc Attaining FC Attaining FBC Attaining AgI Attaining AgL Attaining	1997-1999 6 samples 3 sampling events	OK				Attaining	ADEQ collected 6 samples at 2 sites in 1997-1999. Reach assessed as "attaining all uses."

TABLE 28. UPPER GILA (Safford-San Carlos-Duncan) WATERSHED - MONITORING DATA - 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Coleman Creek headwaters-Campbell Blue AZ15040004-040 A&Wc, FC, FBC, AgL	ADEQ Biocriteria program Below Turkey Creek UGCOL002.49 100523	1996 - 1 suite	OK					
	Summary Row	1996 1 sampling events					Not assessed	Insufficient data to assess.
Eagle Creek headwaters-Willow Creek AZ15040005-028 A&Wc, FC, FBC, DWS, AgI, AgL	ADEQ Biocriteria & Fixed Station Above Honeymoon Campground UGEAG035.99 100535	1996 - 1 suite 2000 - 4 suites	Dissolved oxygen mg/L	7.0 90% saturation (A&Wc)	5.8-8.2 (77-98%)	1 of 5		Naturally low dissolved oxygen due to ground water upwelling. Exceedance not included in final assessment.
	Summary Row A&Wc Attaining FC Attaining FBC Attaining DWS Attaining AgI Attaining AgL Attaining	1996-2000 5 sampling events	OK				Attaining	ADEQ collected 5 samples in 1996-2000. Reach assessed as "attaining all uses."
Eagle Creek Willow Creek-Sheep Wash AZ15040005-027 A&Wc, FC, FBC, DWS, AgI, AgL	ADEQ Biocriteria & Fixed Station Below Sheep Wash Crossing UGEAG023.34 100536	2000 - 4 suites	Turbidity NTU	10 (A&Wc)	4-13	1 of 4		
	Summary Row A&Wc Inconclusive FC Attaining FBC Attaining DWS Attaining AgI Attaining AgL Attaining	2000 4 samples	Turbidity NTU	10 (A&Wc)	4-13	1 of 4	Inconclusive	ADEQ collected four samples in 2000. Reach assessed as "attaining some uses." Add to Planning List due to turbidity exceedance.
Eagle Creek Sheep Wash-Gila River AZ15040005-025 A&Wc, FC, FBC, DWS, AgI, AgL	ADEQ TMDL Program At confluence with Gila River UGEAG000.05 100817	1997 - 5 suites (1 suite, and 4 field, copper, zinc), 1998 - 1 suite	Dissolved oxygen mg/L	7.0 90% saturation (A&Wc)	5.6-10.0	1 of 6		Naturally low dissolved oxygen due to ground water upwelling. Exceedance not included in final assessment.
			Turbidity NTU	10 (A&Wc)	1-233	2 of 6		
	ADEQ Fixed Station Network Below Gold Gulch @ Morenci UGEAG006.05 100806	2000 - 4 suites	Turbidity NTU	10 (A&Wc)	<1-26	1 of 4		

TABLE 28. UPPER GILA (Safford-San Carlos-Duncan) WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Wc Inconclusive FC Attaining FBC Attaining DWS Attaining AgI Attaining AgL Attaining	2000 10 sampling events	Turbidity NTU	10 (A&Wc)	<1-233	3 of 10	Inconclusive	ADEQ collected 10 samples at 2 sites in 1997-2000. Reach assessed as "attaining some uses." Add to Planning List due to turbidity exceedances.
East Turkey Creek headwaters -San Simon AZ15040006-837 A&Wc, FC, FBC, AgL	ADEQ Biocriteria program Above Forest Road 42 UGETK007.70 100545	1998 - 1 suite	OK					
	Summary Row	1998 1 sampling events					Not assessed	Insufficient data to assess.
Frye Creek headwaters-Highline Canal AZ15040005-988 A&Wc, FC, FBC, AgI, AgL	ADEQ Biocriteria and Fixed Station At first crossing of Trail 36UGFRY007.00 100720	1996 - 1 suite 2000 - 3 suites	Dissolved oxygen mg/L	7.0 90% saturation (A&Wc)	6.3-7.8 (73-86%)	2 of 4		Naturally occurring low dissolved oxygen due to very low stream flow (less than 0.1 cfs). Exceedance not included in final assessment.
	Summary Row A&Wc Attaining FC Attaining FBC Attaining AgL Attaining	1996-2000 4 samples	OK				Attaining	ADEQ collected 4 samples in 1996-2000. Reach assessed as "attaining all uses."
Gila River NM border-Bitter Creek AZ15040002-004 A&Ww, FC, FBC, AgI, AgL	USGS Station #0943200 Below Blue Creek, Virden, NM UGGLR213.01 100728	1998 - 6 suites 1999 - 5 suites 2000 - 4 suites	Turbidity NTU	50 (A&Ww)	1-130	3 of 15		Samples taken in New Mexico. Used only as supporting data. Not included in final assessment.
	ADEQ Fixed Station Network Duncan @ New Mexico border UGGLR205.35 100808	2000 - 2 suites	OK					
	USGS Station #09431500 Near Redrock, New Mexico UGGLR219.53	1996 - 6 suites 1999 - 3 suites 2000 - 3 suites	Turbidity NTU	50 (A&Ww)	<1-10,000	1 of 7		Samples taken in New Mexico. Used only as supporting data. Not included in final assessment.
	Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	1996-2000 2 samples (in Arizona)					Inconclusive	ADEQ collected 2 samples in 2000. Reach assessed as "inconclusive"because of insufficient data collected in Arizona. Exceedances in New Mexico and downstream in Arizona suggest that turbidity may be impairing this reach.

TABLE 28. UPPER GILA (Safford-San Carlos-Duncan) WATERSHED - MONITORING DATA - 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Gila River Skully Creek-San Francisco AZ15040002-001 A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Program Above San Francisco River UGGLR195.11 100810	1997 - 1 suite + 4 metals, nutrients 1998 1 suite	Turbidity NTU	50 (A&Ww)	7-1000	5 of 6		
	ADEQ Fixed Station Network Above Old Safford Bridge UGGLR197.26 100809	2000 - 4 suites	Turbidity NTU	50 (A&Ww)	2-65	1 of 4		
	Summary Row A&Ww Inconclusive FC Attaining FBC Attaining AgI Attaining AgL Attaining	1997-2000 10 sampling events	Turbidity NTU	50 (A&Ww)	2-1000	6 of 10	Inconclusive	ADEQ collected 10 samples at 2 sites in 1997-2000. Reach assessed as "attaining some uses." Add to Planning List due to turbidity exceedances.
Gila River San Francisco River-Eagle Cr AZ15040005-024 A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Program Above Eagle Creek UGGLR193.68 100812	1997 - 1 suite + 4 field, Cu, Zn, 1998 - 1 suite	Turbidity NTU	50 (A&Ww)	7-458	6 of 6		
	ADEQ TMDL Program Below San Francisco River UGGLR194.91 100811	1997 - 1 suite + 4 field, metals 1998 - 1 suite	Turbidity NTU	50 (A&Ww)	6-701	6 of 6		
	Summary Row A&Ww Inconclusive FC Attaining FBC Attaining AgI Attaining AgL Attaining	1997-2000 12 samples 6 sampling events	Turbidity NTU	50 (A&Ww)	6-701	12 of 12	Inconclusive	ADEQ collected a total of 12 samples at 2 sites in 1997-2000. Reach assessed as "attaining some uses." Add to Planning List due to turbidity exceedances.
Gila River Eagle Creek-Bonita Creek AZ15040005-023 A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Program Below Eagle Creek UGGLR193.47 100813	1997 - 1 suite + 4 field, Cu, Zn, 1998 -1 suite	Turbidity NTU	50 (A&Ww)	10-356	5 of 6		
	ADEQ TMDL Program Above Bonita Creek UGGLR190.39 100814	1997 - 4 suites + 1 field, bacteria 1998 - 1 suite	Turbidity NTU	50 (A&Ww)	12-413	4 of 6		
	Summary Row A&Ww Inconclusive FC Attaining FBC Attaining AgI Attaining AgL Attaining	1997-1998 12 samples 6 sampling events	Turbidity NTU	50 (A&Ww)	12-413	9 of 12	Inconclusive	ADEQ collected 6 samples in 1997-2000. Reach assessed as "attaining some uses." Add to Planning List due to turbidity exceedances.

TABLE 28. UPPER GILA (Safford-San Carlos-Duncan) WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Gila River Bonita Creek-Yuma Wash AZ15040005-022 A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Program Below Bonita Creek UGGLR190.45 100815	1997 - 5 suites 1998 - 1 suite	Turbidity NTU	50 (A&Ww)	11-630	5 of 6		
	USGS Station #09448500 Solomon above Safford Valley UGGLR188.98 100729	1996 - 6 suites 1997 - 6 suites 1998 - 6 suites 1999 - 5 suites 2000 - 4 suites	Escherichia coli CFU	580 (FBC)	<1 - 2500	1 of 27		
			Fecal coliform CFU	4000 (A&Ww, AgI, AgL)	1-10000	2 of 27 more than 5 years apart		
			Turbidity NTU	50 (A&Ww)	<1-3000	8 of 27		
	Summary Row A&Ww - Impaired FC - Attaining FBC - Attaining AgI - Attaining AgL - Attaining	1996-2000 33 samples	Turbidity NTU	50 (A&Ww)	<1-3000	13 of 33	Impaired	ADEQ collected 6 samples and USGS collected 27 samples in 1996-2000. Reach assessed as "impaired" due to turbidity.
			Escherichia coli CFU	580 (FBC)	<1 - 2500	1 of 27	Attaining	
			Fecal coliform CFU	4000 (A&Ww, AgI, AgL)	1-10000	2 of 33 >5 years apart	Attaining	
K P Creek headwaters-Blue River AZ15040004-029 A&Wc, FC, FBC, AgI, DWS	ADEQ Fixed Station Network @ Blue River UG0KP000.08 100889	2000 - 2 suites + 1 nutrients + field, bacteria	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.2-7.6 (65-91%)	2 of 4		Naturally occurring low dissolved oxygen due to very low stream flow (less than 0.1 cfs). Exceedance not included in final assessment. Only 1 metals sample.
	ADEQ Fixed Station Network Below K P Cienega UG0KP006.59 100888	2000 - 1 suite	OK					Intermittent or ephemeral flow.
	Summary Row A&Wc - Inconclusive FC - Inconclusive FBC - Inconclusive AgL - Inconclusive DWS - Inconclusive	2000 4 samples 3 sampling events Missing core parameters	OK				Inconclusive	ADEQ monitored 2 sites in 2000. Reach assessed as "inconclusive" due to insufficient metals samples.
North Fork Cave Creek headwaters - Cave Creek AZ15040006-856 A&Wc, FC, FBC, AgI, AgL Unique Waters	ADEQ Unique Waters Program Above confluence with Cave Cr. UGNCV000.03 101129	1999 - 1 suite	OK					
	Summary Row	1999 1 sampling event					Not assessed	Insufficient data to assess.

TABLE 28. UPPER GILA (Safford-San Carlos-Duncan) WATERSHED - MONITORING DATA - 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
San Francisco River headwaters-New Mexico AZ15040004-023 A&Wc, FC, FBC, AgI, AgL	ADEQ Fixed Station Network Above Luna Lake UGSFR059.98 100381	1996 - 4 suites + 2 bacteria 1999 - 2 suites 2000 - 2 suites	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.6-9.4 (72-100%)	1 of 8		
			Turbidity NTU	10 (A&Wc)	6-61	7 of 8		
	Summary Row A&Wc Inconclusive FC Attaining FBC Attaining AgI Attaining AgL Attaining	2000 10 sampling events	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.6-9.4 (72-100%)	1 of 8	Inconclusive	ADEQ collected 10 samples in 1997-2000. Reach assessed as "attaining some uses"and added to the Planning List due to DO and turbidity exceedances.
			Turbidity NTU	10 (A&Wc)	6-61	7 of 8	Inconclusive	
San Francisco River New Mexico-Blue River AZ15040004-004 A&Ww, FC, FBC, AgI, AgL	ADEQ Fixed Station Network Near Martinez Ranch UGSFR017.66 100834	2000 - 4 suites	Turbidity NTU	50 (A&Ww)	3-74	1 of 4		Missing core parameters: insufficient metals samples.
	Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	2000 4 sampling events Missing core parameters	Turbidity NTU	50 (A&Ww)	3-74	1 of 4	Inconclusive	ADEQ collected 4 samples in 2000. Reach assessed as inconclusive" and added to the Planning List due to missing core parameters (metals) and turbidity exceedances.
San Francisco River Blue R.-Limestone Gulch AZ15040004-003 A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Program and Fixed Station 6 miles above Clifton (& mining) UGSFR011.29 100708	1997 - 5 suites 1998 - 1 suite 1999 - 3 suites 2000 - 4 suites	Beryllium µg/L	0.21 (FC)	1.1	1 of 1		9 other beryllium samples were not included because the detection limit was too high to assess Fish Consumption.
			Turbidity NTU	50 (A&Ww)	1-872	4 of 11		
	Summary Row A&Ww Inconclusive FC Inconclusive FBC Attaining AgI Attaining AgL Attaining	1997-2000 13 sampling events	Beryllium	0.21 (FC)	1.1	1 of 1	Inconclusive	ADEQ collected 13 samples in 1997-2000. Reach assessed as "attaining some uses"and added to the Planning List due to turbidity and beryllium exceedances
			Turbidity NTU	50 (A&Ww)	1-872	4 of 11	Inconclusive	
San Francisco River Limestone Gulch-Gila River AZ15040004-001 A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Program At confluence with Gila River UGSFR000.04 100818	1997 - 6 suites 1998 - 1 suite	Turbidity NTU	50 (A&Ww)	3-176	2 of 6		
	ADEQ TMDL Program and Fixed Station Below Clifton (below mining) UGSFR003.04 100382	1996 - 6 suites 1997 - 4 suites + 1 metals, inorganics 1998 - 4 suites + 2 bacteria + 1 nutrients, metals 1999 - 5 suites 2000 - 4 suites	Beryllium µg/L	0.21 (FC)	<0.5-12.5	2 of 23		
			Beryllium µg/L	4 (FBC)	<0.5-12.5	1 of 23		
			Copper (dissolved) µg/L	varies (62) (A&Ww)	<10-170	1 of 29		

TABLE 28. UPPER GILA (Safford-San Carlos-Duncan) WATERSHED - MONITORING DATA - 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.2-10.3 (82-133%)	2 of 27		
			Escherichia coli CFU	580 (FBC)	<2-3,200	1 of 24		
			Fecal coliform CFU	4000	<2-4,600	1 of 20		
			Turbidity NTU	50 (A&Ww)	<1-1000	7 of 27		Only two samples were related to high flows.
	Summary Row A&Ww Impaired FC Attaining FBC Attaining AgI Attaining AgL Attaining	2000 33 samples 26 sampling events	Turbidity NTU	50 (A&Ww)	3-176	9 of 33	Impaired	ADEQ collected 33 samples at two sites in 1996-2000. Reach assessed as "impaired" due to turbidity.
			Beryllium µg/L	1 (0.21 (FC)	<0.5-12.5	2 of 23	Attaining	
			Beryllium µg/L	4 (FBC)	<0.5-12.5	1 of 23	Attaining	
			Copper (dissolved) µg/L	varies (57) (A&Ww)	<10-170	1 of 29	Attaining	
			Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.2-10.3 (82-133%)	2 of 27	Attaining	
			Escherichia coli CFU	580 (FBC)	<2-3,200	1 of 24	Attaining	
			Fecal coliform CFU	4000	<2-4,600	1 of 20	Attaining	
South Fork Cave Creek headwaters-Cave Creek AZ15040006-849 A&Wc, FC, FBC, AgI, AgL Unique Waters	ADEQ Unique Waters Program Above confluence with Cave Cr. UGSCV000.12 101109	1997 - 1 suite 1998 - 1 suite 1999 - 1 suite	Dissolved oxygen mg/L	7.0 90% saturation (A&Wc)	6.2-7.8 (85.6-97.4)	1 of 3		Naturally occurring low dissolved oxygen due to very low stream flow (less than 0.1 cfs). Exceedance not included in final assessment.
	ADEQ Biocriteria & Fixed Station Above South Fork Campground UGSCV002.26 100639	1997 - 1 field, nutrients, inorganics 1998 - 1 suite 1999 - 1 suite + 1 - metals, inorganics 2000 - 4 suites	Dissolved oxygen mg/L	7.0 90% saturation (A&Wc)	3.6-7.9 (39.5-91.3%)	3 of 7		Naturally low dissolved oxygen due to ground water upwelling. Exceedance not included in final assessment.
			Turbidity NTU	10 (A&Wc)	<1-36	1 of 7		Very high flow (normally < 1 cfs, flow at 22 cfs). Pristine watershed.
	ADEQ Biocriteria Program Above South Fork Campground UGSCV002.45 100640	1998 - 1 suite	OK					

TABLE 28. UPPER GILA (Safford-San Carlos-Duncan) WATERSHED - MONITORING DATA - 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Wc Attaining FC Attaining FBC Attaining AgI Attaining AgL Attaining UW Attaining	1997-2000 11 samples 7 sampling events	Turbidity NTU	10 (A&Wc)	<1-35	1 of 11	Attaining	ADEQ collected a total of 12 samples at 2 sites in 1997-2000. Reach assessed as "attaining all uses."
LAKES MONITORING DATA								
Dankworth Pond AZL15040005-0440 A&Wc, FC, FBC	ADEQ Lakes Program UGDAN-A 100018	1997 - 4 suites 2000 - 3 suites	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4.3-8.1 60-86%	5 of 6		Naturally low dissolved oxygen due to ground water upwelling. Exceedances not included in final assessment. Naturally high fluoride levels in ground water. Exceedances not included in final assessment. Naturally high selenium levels in ground water. Exceedance not included in final assessment. Missing core parameters: *Escherichia coli*.
			Fluoride mg/L	8.4 (FBC)	14-17	7 of 7		
			Selenium µg/L	20 (A&Wc)	<5-25	1 of 7		
	ADEQ Lakes Program UGDAN-B 100987	2000 - 2 nutrients, field	Dissolved oxygen mg/L	7 (90% saturation) (A&Wc)	4.4-7.7 (50-102%)	1 of 2		
	ADEQ Lakes Program UGDAN-Spring 1 (pond) 100988	2000 - 2 suites + 1 pH, DO	Dissolved oxygen mg/L	7 (90% saturation) (A&Wc)	3.6-5.8 (57-75%)	3 of 3		
			Fluoride mg/L	8.4 (FBC)	12.0-13.0	2 of 2		
	ADEQ Lakes Program UGDAN-Springs 2, 3, 4 100990, 100991, 100992	1997 - 1 suite 2000 - 1 suite (at 3 springs)	Dissolved oxygen mg/L	7 (90% saturation) (A&Wc)	0.1-2.6	4 of 4		
			Fluoride mg/L	8.4 (FBC)	12.0-17.0	2 of 2		
	Summary Row A&Wc Attaining FC Attaining FBC Inconclusive	1997-2000 13 samples 7 sampling events Missing bacteria samples	OK				Attaining	ADEQ collected a total of 13 samples at 4 sites in 1997-2000. Lake assessed as "attaining some uses" and added to the Planning List due to missing core parameters (bacteria).
Luna Lake AZL15040004-0840 A&Wc, FC, FBC, AgL	AGFD Routine Monitoring UGLUN	1997 - 1 suite 1998 - 2 suites	pH SU	6.5-9.0 (A&Wc, FBC, AgL)	8.4-9.9	2 of 3		Missing core parameters: *Escherichia coli*
	ADEQ Lakes Program UGLUN-A 100036	1997 - 4 suites 2000 - 1 suite	Dissolved oxygen mg/L	7 (90% saturation) (A&Wc)	5.4-10.1 (51-145%)	1 of 5		
			pH SU	6.5-9.0 (A&Wc, FBC, AgL)	7.2-9.7	2 of 5		
	ADEQ Lakes Program UGLUN-B 100979	2000 - 1 suite	OK					

TABLE 28. UPPER GILA (Safford-San Carlos-Duncan) WATERSHED – MONITORING DATA – 2002 ASSESSMENT								
STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Ww Not attaining FC Attaining FBC Not attaining AgL Not attaining	1997-2000 9 samples 7 sampling events Missing bacteria samples	pH SU	6.5-9.0 (A&Wc, FBC, AgL)	7.29-9.9	4 of 8	Not attaining	ADEQ collected 6 samples and AGFD collected 3 samples in 1997-2000. Reach assessed as "not attaining" due to exceedances and a TMDL completed and approved by EPA in 2000 for high pH and narrative nutrients. Added to the Planning List for effectiveness monitoring.
			Dissolved oxygen mg/L	7 (90% saturation) (A&Wc)	5.4-10.1 (51-145%)	1 of 8	Inconclusive	
Roper Lake AZL15040005-1250 A&Ww, FC, FBC	ADEQ Lakes Program UGROP - A 100080	1997 - 4 suites 2000 - 3 suites	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.4-9.1 (74-105%)	2 of 5		Naturally low dissolved oxygen due to ground water upwelling. Exceedances not included in final assessment. Naturally high fluoride levels in ground water. Exceedances not included in final assessment. Missing core parameters: *Escherichia coli*
			Fluoride mg/L	8.4 (FBC)	6.8-18.0	7 of 7		
	ADEQ Lakes Program UGROP - B 100975	1997 - 4 suites 2000 - 3 suites	Fluoride mg/L	8.4 (FBC)	15.0-16.0	2 of 2		
	ADEQ Lakes Program UGROP - Pond 100976	2000 - 2 suites	OK					
	ADEQ Lakes Program UGROP - Canal 100978	2000 - 2 suites	Fluoride mg/L	8.4 (FBC)	15.0-16.0	2 of 2		
	Summary Row A&Ww Attaining FC Attaining FBC Inconclusive	1997-2000 18 samples 7 sampling events Missing core parameters					Attaining	ADEQ collected samples at up to 4 sites during 7 sampling events in 1997-2000. Lake assessed as "attaining some uses" due to missing core parameters.

Information for Interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from using AZ (for streams) or AZL (for lakes) + Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses", "Agency", and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" – This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" – The year and number of water samples is shown. The federal "water year is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
  - "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among samples as many different programs and agencies provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
  - "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
  - If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters
- "Standards Exceeded at this Site per Sampling Event."
  - Although many parameters may be analyzed, only those exceeding a standard are shown.
  - "OK" indicates that no standards were exceeded.
  - The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
  - "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
  - A mean or geometric mean will be shown along with the range of results if applicable to the standard.

- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or " Inconclusive." See assessment criteria in Chapter III of Volume I.

Ground Water Assessments in the Upper Gila Watershed

Major ground water stressors -- Monitoring data collected from wells in this watershed between October 1995-October 2000 are summarized in **Table 29** and illustrated in **Figures 54, 55, and 56.**

Of the 50 wells monitored, nine exceeded fluoride standards, 7 exceeded standards for metals, and 5 exceeded nitrate standards. The location of the wells monitored and the wells exceeding standards is illustrated in **Figure 54**. Exceedances occurred across the watershed, rather than in an isolated pocket, except that wells in the southern section (around San Simon, Arizona) did not exceed metal standards.

TDS concentrations -- Water quality can be characterized based on concentration of Total Dissolved Solids (TDS). High levels of salinity limits the practical uses of ground water in some areas of this watershed as TDS over 500 mg/L has an off-flavor, and TDS over 1000 mg/L will limit its use for some crops. As illustrated in **Figure 55**, the elevated TDS is scattered across the watershed, with exceptionally high concentration at one well in the San Simon area.

Watershed Protection Fund projects have been used to cap off one high saline well and investigate impacts of other wells (see discussion of these projects in the last section of this watershed).

No TDS water quality standards apply in this watershed and the elevated levels of TDS do not present a human-health concern for drinking water. The TDS concentration is only used to generally characterize water quality.

Nitrate concentrations -- Water quality can also be characterized by looking at the concentration of nitrates in ground water. Natural occurring nitrate concentrations in ground water are generally below 3 mg/L. Concentrations above 5 mg/L indicate potential anthropogenic sources of nitrates. A total of eleven wells of the fifty wells sampled, exceeded this level. As illustrated in **Figure 56**, elevated nitrates occur in the San Simon area and downstream from Safford, both areas have significant irrigated crop production, which may be one source of the elevated nitrates.

When nitrate concentrations exceed 10 mg/L, Arizona's Aquifer Water Quality Standard has been exceeded. This standard was set to protect human health , as water with nitrate greater than 10 mg/L may present a health problem for infants and should not be consumed by nursing mothers. Five of the eleven elevated nitrate samples exceeded 10 mg/L. As many of the wells sampled are irrigation wells (not used for drinking water), nitrates over 10 mg/L may not represent a human-health concern. However, efforts should be made to minimize further ground water contamination by nitrate.

Table 29. Upper Gila (Safford-San Carlos-Duncan) Watershed Ground Water Monitoring 1996 - 2000

MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	0		--	--
	Fluoride	1		0	0%
	Metals/Metaloids	1		0	0%
	Nitrate	1		0	0%
	VOCs + SVOCs*	0	--	--	--
	Pesticides	0	--	--	--
TARGETED MONITORING WELLS	Radiochemicals	5		0	0%
	Fluoride	47		9	19%
	Metals/metaloids	47		7	15%
	Nitrate	49		5	10%
	VOCs + SVOCs*	7	0	0	0%
	Pesticides	7	0	0	0%

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells (all targeted wells)	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
34	13	7	13	1

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells (only 1 index well)	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
50	39	6	5

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.

*The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.

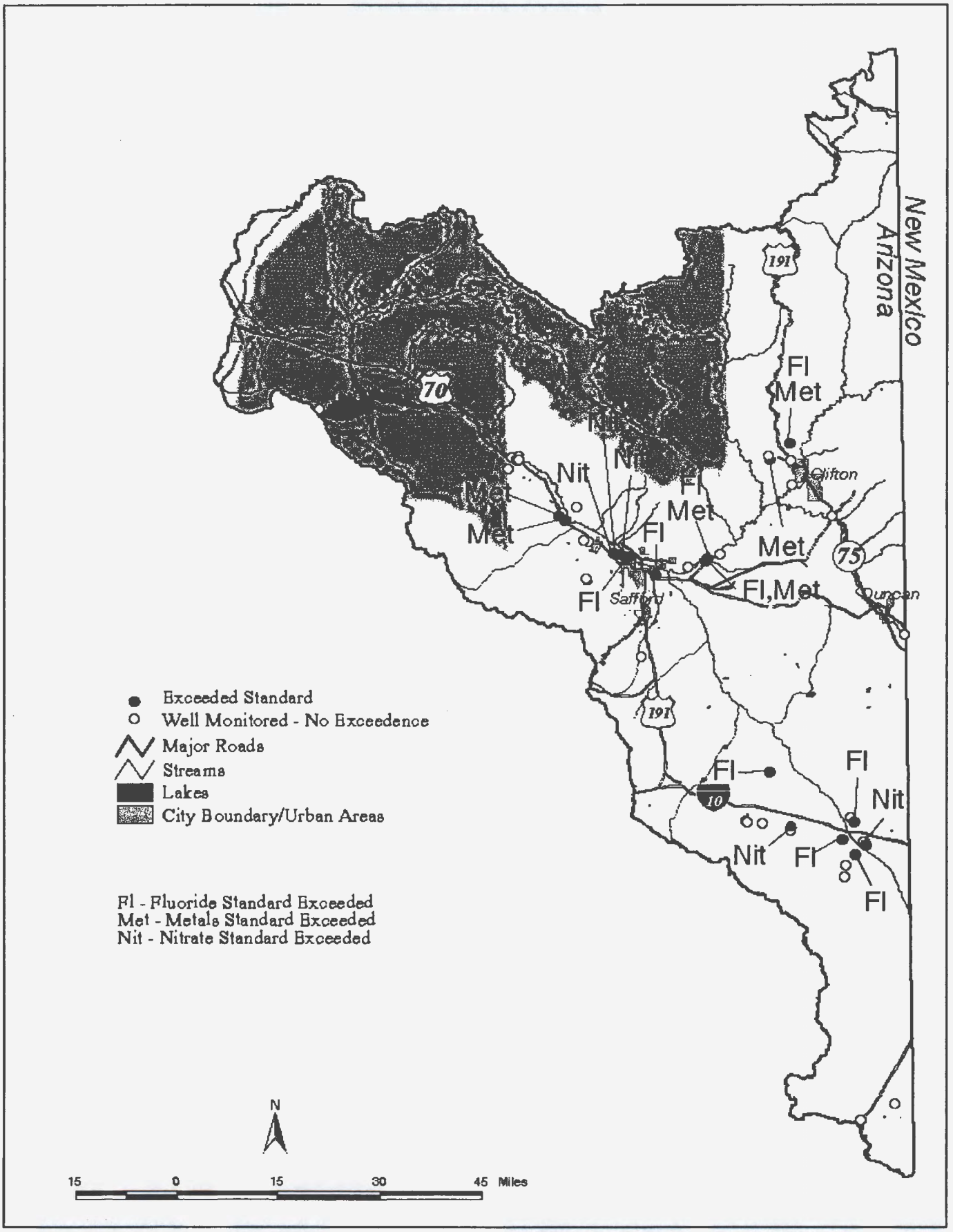

Figure 54. Ground Water Monitoring in the Upper Gila (Safford-San Carlos-Duncan) Watershed

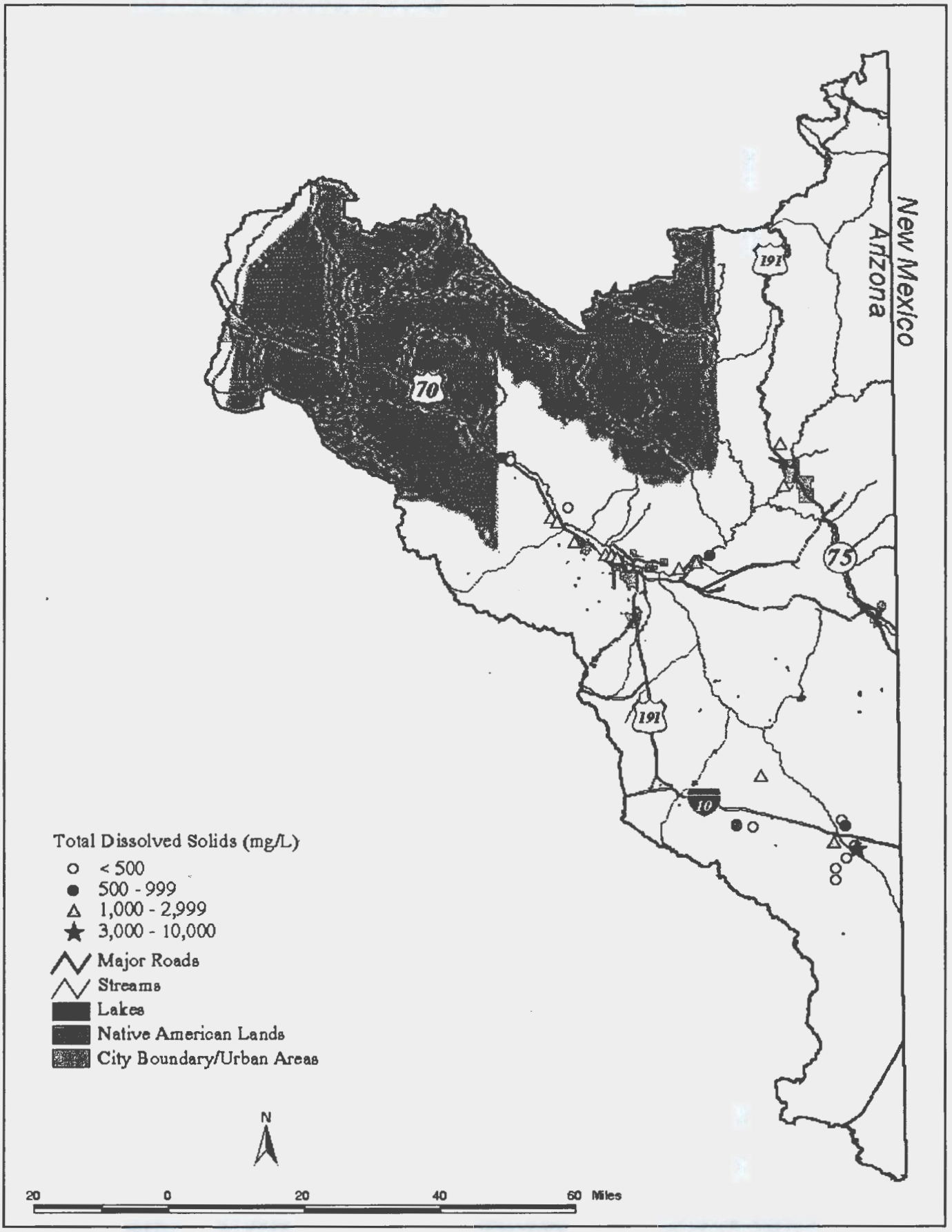

Figure 55. Classification of Ground Water Quality by TDS Concentration in the Upper Gila Watershed

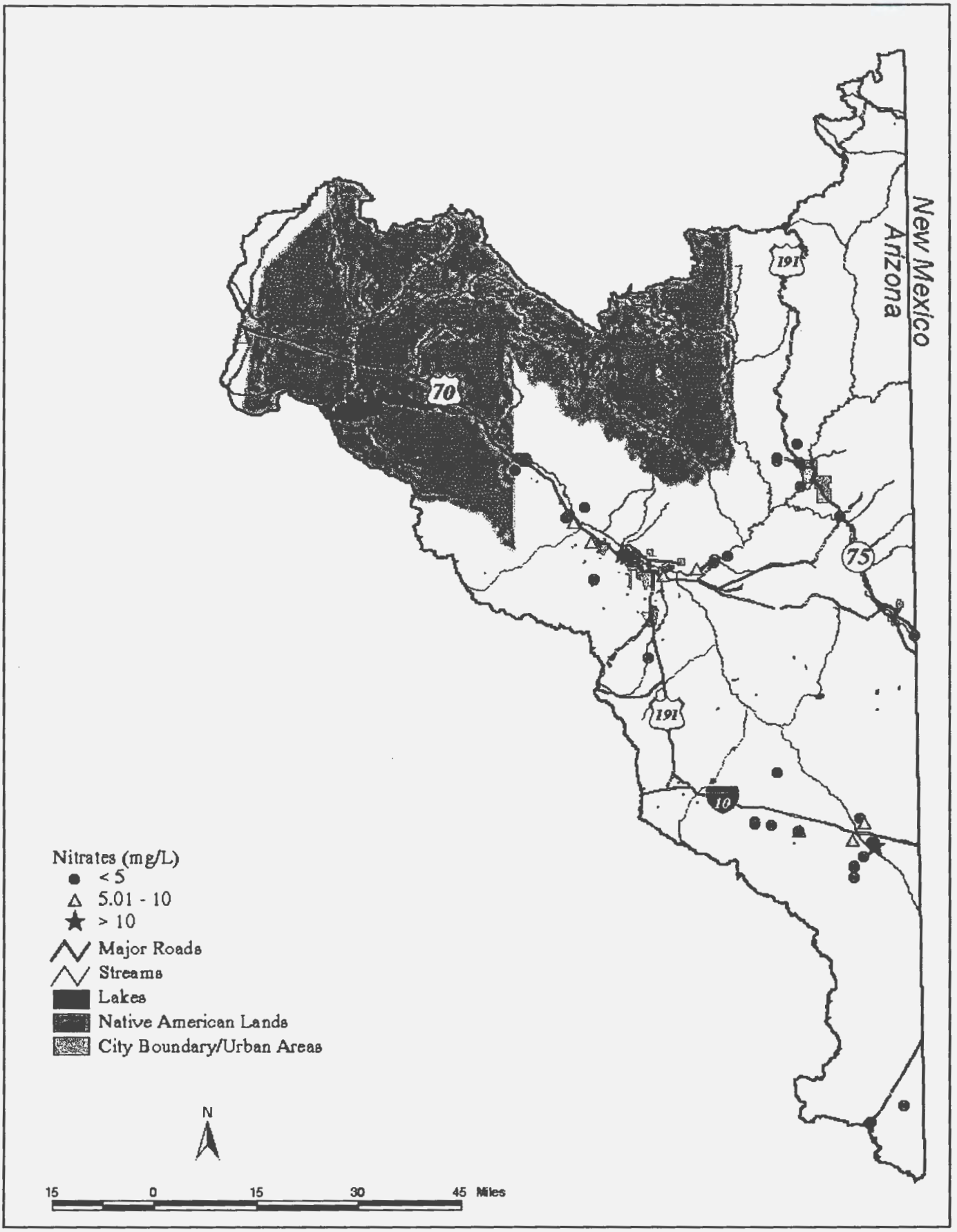

Figure 56. Classification of Ground Water Quality by Nitrate Concentration in the Upper Gila Watershed

Watershed Studies and Alternative Solutions in the Upper Gila (Safford-San Carlos-Duncan) Watershed

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the Upper Gila Watershed. Watershed partnerships active in this watershed are also mentioned.

Surface Water Studies and Mitigation Projects

Total Maximum Daily Load Analyses – The following TMDL analyses have been completed or are ongoing in this watershed. Further information about the status of these investigations can be obtained by contacting the TMDL Program manager at (602) 207-4468, or at ADEQ's web site: http://www.adeq.state.az.us/environ/water/assess.

- Luna Lake TMDL -- A TMDL for pH and excessive nutrients was completed and approved by EPA in 2000. Historic high external inputs of nutrients (nitrogen and phosphorus) to the lake, along with current in-lake nutrient cycling and many sunny days have resulted in a highly productive (eutrophic) system that has repeatedly failed to meet surface water quality standards.

  The TMDL investigation indicated that the following nonpoint sources contribute nutrients that lead to the impairment: septic systems, forest runoff, agricultural runoff, residential and commercial runoff, decomposition of aquatic plants (i.e., in-lake nutrient cycling), and ground water. To meet standards, the TMDL concluded that the following reductions from historic levels will need to be made:

  46% less nitrogen -- down to 69.4 pounds per day,
  67% less phosphorus – down to 19 pounds per day, and
  37% less *Chrolophyll a* (a measure of algal production).

  The TMDL recommended the following reductions for the following nonpoint source categories :

	Nitrogen	Phosphorus
septic systems	50%	50%
residential	50%	50%
livestock	25%	25%
elk	25%	25%
marcophyte decomposition	60%	60%

The TMDL identified the following implementation options to meet these reductions:

- Determine the number of remaining septic systems that are in use and the extent to which unused systems are continuing to leach nutrients to Luna Lake. If there are a large number of active improperly functioning systems, the community could consider extending sewer lines.
- Implement voluntary grazing Best Management Practices that could reduce runoff and loading for pastures to reduce loading from domestic and elk herds.
- Implement voluntary Best Management Practices that reduce runoff from residential areas. This runoff is generally caused by impervious surfaces and soil amendments (e.g., fertilizers for lawns).
- Use dredging to remove the top meter of sediments that have accumulated most of the nutrients, and thereby, reduce nutrient recycling (Baker and Farnworth, 1995).
- Maintain a macrophyte harvesting schedule and/or biological controls of the macrophytes, as macrophytes will re-colonize Luna Lake within a short period of time after dredging has been completed.
- Increasing irrigation system efficiency to reduce irrigation water withdrawals, and thereby, provide higher quality lake water.

The goal of this TMDL is to incrementally improve water quality. ADEQ will work with the local community and cooperating agencies to develop a monitoring program for Luna Lake to assess whether the management actions are being met.

Water Quality Improvement Grants – ADEQ awarded the following Water Quality Improvement Grants in this watershed:

- Apache County Luna Lake Improvement Project -- Apache County will dredge accumulated sediment from Luna Lake to increase dissolved oxygen levels, reduce quantities of nutrient-rich sediments on the lake's bottom, lower average pH, and reduce total phosphorous. In addition, the county will establish water quality monitoring points along the San Francisco River to help identify locations of faulty septic systems and provide financial assistance to repair or replace faulty septic systems. For more information contact Cathy Cosgrove at (520) 333-2680 or heroconsulting@hotmail.com.

- Road Rehabilitation to Reduce Sediment in the San Simon Watershed – The Coronado Resource Conservation and Development District plans to rehabilitate 14 miles of unimproved roads within this sub-watershed using structures at strategic locations to decrease sediment loading to the San Simon. In addition, they are to increase public awareness of erosion and sediment control and how they relate to water quality within this watershed. For further information, contact Pete Brawley of the Safford-San Carlos-Duncan Watershed group at (520) 428-2607.

Water Protection Fund Projects – The following projects received Water Protection Funds from the Arizona Department of Water Resources:

- Fluvial Geomorphology Study and Demonstration Project to Enhance and Restore Riparian Habitat on the Gila River from the New Mexico Border to the San Carlos Nation -- Several streams in this watershed are impaired due to excessive turbidity; therefore, significant resources are being invested to understanding the natural and anthropogenic fluvial geomorphic conditions and attributes that have lead to these exceedances. Gila County and the Safford-San Carlos-Duncan Watershed Group have initiated a landmark study of 100 miles of the Gila River from New Mexico border to the San Carlos Indian Nation border. This study will form the basis for the development of demonstration projects which will be implemented at optimum sites along the river to restore riparian vegetation, reduce flood velocity, and create a more stable channel. This project is being funded by the Arizona Watershed Protection Fund and the Bureau of Reclamation. The project is scheduled for completion in 2002.

- Gila Box Riparian and Water Quality Improvement Project – The Bureau of Land Management improved riparian habitat and water quality within the Gila Box Riparian National Conservation Area by moving livestock grazing from the river to adjacent upland areas. Approximately six miles of fencing were constructed and water lines, stock tanks, and water pumps were installed to provide water to the upland area. This project was completed in 1999.

- Eagle Creek Watershed and Riparian Stabilization Project –A private land owner received funds to improve the watershed, upland range and riparian community of Eagle Creek through the installation of fencing, grazing management, and the expansion of existing pipeline to distribute water sources throughout the upland areas. This project was completed in 1999.

- Creation of a Reference Riparian Area in the Gila Valley – Mt. Graham International Science and Culture Foundation created a highly visible riparian system along a tributary to the Gila River. The project was awarded Arizona Watershed Protection Funds in 2000 to provide outreach and education on the benefits of establishing and maintaining riparian areas and techniques used by land management areas.

- Blue Box Crossing – Greenlee County was funded to construct a hardened (concrete and riprap) crossing on the Blue river. The project site lies within a steep canyon of the Blue River, which is characterized by high intensity flows (estimated at 11 CFS normal flow and 17,000 CFS during extreme flood flows). The existing gravel crossing washes out in high flows increasing the sediment downstream. The area is habitat for the loach minnow, a species federally listed as Threatened with the potential to be listed as Endangered.

Gila River Resource Inventory – The Bureau of Land Management, the Gila Valley Natural Resource Conservation District, and the San Carlos - Safford - Duncan Watershed Group pooled resources in 1999 to develop a natural resources inventory and further studies to assist in developing Best Management Practices or other methods to improve watershed conditions and reduce nonpoint source pollution .

San Simon Wash Suspended Sediment Monitoring Project –For a 13 year period beginning in 1983, the Bureau of Land Management conducted a monitoring project to determine the effectiveness of range management projects and practices within San Simon Wash drainage area. The parameters examined included: precipitation, storm water flow, movement of suspended sediment, free salt ions in solution (electrical conductivity). Range management practices included: a reduction of cattle numbers, fencing of riparian areas, construction of rock-masonry dams, installation of watering areas to disperse livestock and wildlife range use, concrete river fords, grass seeding, and other erosion control structures.

BLM concluded that the stream channel, and possibly some of the watershed, is slowly recovering from over 100 years of abuse. A decline in storm flow and sediment yield, were viewed as an indication that the construction of erosion control structures and implementation of a number of range management practices are effective.

Ground Water Studies and Mitigation Projects

Water Protection Fund Projects – Water Protection Funds were also used to fund the following ground water quality projects in this watershed:

- Abandonment of an Artesian Geothermal Wells – In 1999, Smithville Canal Company received funds to properly cap a deep, abandoned, artesian geothermal well near the Gila river, north of Thatcher Arizona. Discharge from the well was highly saline and was degrading soils and plants in the vicinity, and possibly, degrading downstream water quality in the Gila River. The grantee is now monitoring the site to evaluate changes due to well abandonment.

- Stable Isotope Tracers of Water Quality Constituents in the Upper Gila River – Decades of water quality monitoring have documented concentrations of total dissolved solids (TDS) in the Gila River and ground water, but the precise sources (both natural and anthropogenic) of the TDS are not known. In this project, the Arizona Geological Survey was to identify the sources and conveyance points of dissolved solids entering the upper Gila River through the use of naturally-occurring stable isotopes. The study area encompasses approximately 200 square miles in southeastern Arizona. Based on the results of the study, Arizona Geological Survey is to develop recommendations for mitigation of excessive TDS concentrations and further studies in the region. This project was completed in 1999.

- Tritium as a Tracer of Ground Water Sources and Movement in the Upper Gila Drainage – The Arizona Geological Survey also evaluated the use of tritium (a radioactive isotope) to distinguish between sources of ground water influencing the composition (and salinity) of the Gila River. Tritium can be used to determine the age of ground water. This study will assess the utility of using tritium to determine the degree of mixing between deep ground water in contact with highly soluble salts in the basin-fill sediments, and shallow ground water, which is a mixture of subflow from tributaries, infiltration of Gila River water and possible infiltration of irrigation water. This project was completed in 2000.

Federal and State Superfund Cleanup Sites -- One Superfund site is located in this watershed.

- The Safford Military Range Superfund Site -- This 400 acre site is administered by the Bureau of Land Management has been used by the Arizona Army National Guard (the Guard) since 1927for earth moving equipment training and bivouac activities. The Guard also operated a rifle range here from 1958 to the late 1970's. Recently, the Guard investigated the extent of soil contamination resulting from the numerous lead fragments located throughout the target areas. Lead contamination was shown to be present but confined within the upper six inches of soil. The Guard will to remove all the lead fragments and perform additional sampling to determine if further soil remediation is necessary.

Watershed Partnerships

The Safford-San Carlos-Duncan Watershed Committee – The Safford-San Carlos-Duncan Watershed Group was established in 1993 to develop and implement nonpoint source management strategies and projects in the Upper Gila River Watershed. This citizen and agency based group has been instrumental in addressing water quality issues throughout the watershed, and has initiated many efforts to reduce nonpoint source pollution and educate citizens in the watershed on water quality concerns. Since its institution, its members have sought funding and implemented several important water quality improvement projects, including many of those describe above.

Currently, this watershed group is working to rehabilitate 14 miles of unimproved roads within the watershed using structures at strategic locations to decrease sediment entering the San Simon River. They are also administering the Gila River fluvial geomorphology study, and they have recently capped two saline artesian wells that negatively impacted water quality.

In 2000, the Safford-San Carlos-Duncan Watershed Committee hosted a statewide video television conference concerning ADEQ's then new TMDL program.

For information about meetings, please contact Pete Brawley, Chairman, at (520) 428-2607.

Gila Watershed Forum (formerly the Gila Monster) – The Gila Monster interstate watershed group was formed to coordinate water quality improvement efforts in the upper Gila River drainage area in Arizona and New Mexico. It was formed by the Arizona Department of Environmental Quality in the early 1990's with a primary concern of nonpoint source pollution of water and a secondary concern for natural resources in general. The primary membership consisted of citizens from both states, conservation districts, and county, city, and town governments. They were supported by federal and state agencies concerned with natural resources in both states. Under their leadership, smaller member watersheds in New Mexico and in Arizona developed and implemented many useful projects to protect and enhance natural resources.

In 1998, political differences between factions in the two states began to render the Gila Monster ineffective; however, the four smaller watershed groups (three in New Mexico and one in Arizona) continued to meet on their own and to do important work. In 1999, a group of people began to meet in Silver City, New Mexico under the auspices of EPA Region VI (that oversees New Mexico but not Arizona) and the New Mexico Environmental Department. Using a hired negotiator, this group rewrote the goals and objectives of the former Gila Monster watershed group, changed the organization's bylaws and formed a new group called the Gila Watershed Forum.

Unfortunately, this conversion was done without consulting Arizona's watershed groups. By late 2000, the Gila Watershed Forum had invited the Safford-San Carlos-Duncan Watershed Committee to attend their meetings and become a part of their activities. As of this writing in 2001, the Arizona watershed work group must still decide whether to accept the unilateral changes to the organization to encourage future opportunities for collaboration with New Mexico.

Verde Watershed

VERDE WATERSHED CHARACTERISTICS						
SIZE	6,624 square miles (6% of the state's land area).					
POPULATION BASE	Approximately 153,000 people live in this watershed (estimated from the 2000 census). This is about 3% of the state's population.					
LAND OWNERSHIP **(Figure 57)**	U.S. Forest Service Private	64% 23%	State Land Dept. Tribal land	10% 2%	Other state and federal	1%
LAND USES AND PERMITS **(Figure 58)**	This watershed includes Payson, the Sedona-Cottonwood-Verde Valley area, the majority of Prescott and the southern outskirts of Flagstaff. Primary land uses are grazing, irrigated agriculture, recreation, with some mining and silviculture.					
HYDROLOGY AND GEOLOGY	This watershed is defined by the Verde River drainage area. The Verde River and many of its tributaries are perennial (Brown et al., 1978). Flows from the Verde River are regulated at two reservoirs -- Horseshoe Lake and Bartlett Lake. Flow above Horseshoe Reservoir on the Verde River varies from 48 cfs (1956) to 145,000 cfs (1993), and the annual mean flow since 1946 has been 599 cfs (USGS, 1996). The Mogollon Rim escarpment forms a topographic relief of as much as 2,000 feet and trends northwest across the watershed, dividing the watershed between two Hydrologic Provinces: Central Highlands (southern half), Plateau Uplands (northern half). Elevation ranges from more than 12,000 feet in the San Francisco Mountains to about 1,600 feet in the south. This watershed includes two ground water basins and portions of two active management areas: Verde River, Peach Springs, the northeast half of the Prescott AMA, and a small portion of the Phoenix AMA. Principal aquifers occur in three areas: basin-fill sediment and alluvium (i.e., sands, gravels, clays, conglomerate) interbedded with basalt flows; a shallow alluvial aquifer within the flood plain of the Verde River; and a sequence of limestones and sandstones, typical of the Verde Valley area (ADWR 1994).					
UNIQUE WATERS	Oak Creek and West Fork of Oak Creek					
ECOREGIONS	Arizona-New Mexico Mountains, except the southern tip that is in the Southern Basin and Range.					
OTHER STATES, NATIONS, OR TRIBES	Camp Verde, Tonto Apache, Yavapai-Prescott, and Fort McDowell tribes are stakeholders in this watershed.					

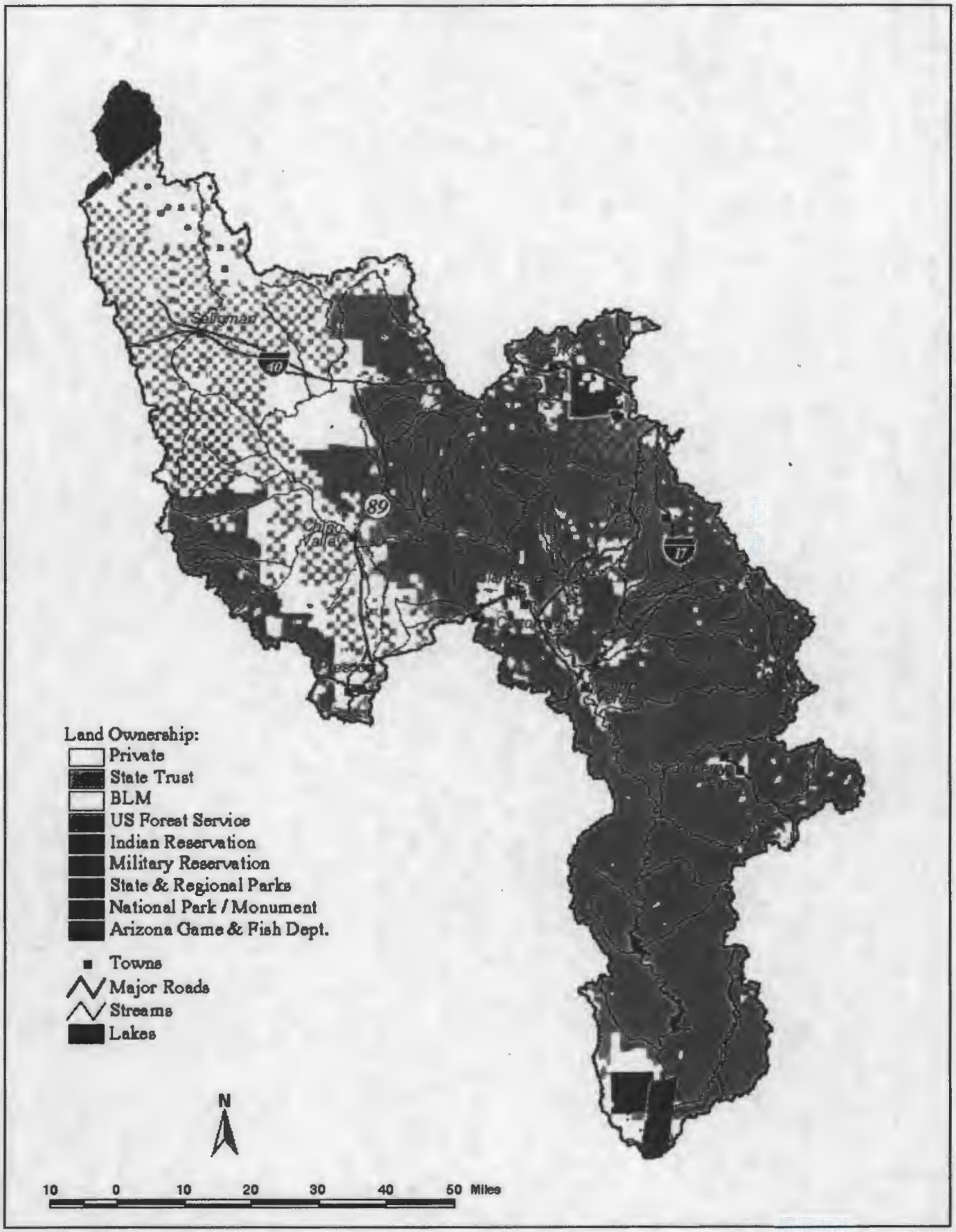

Figure 57. Land Ownership in the Verde Watershed

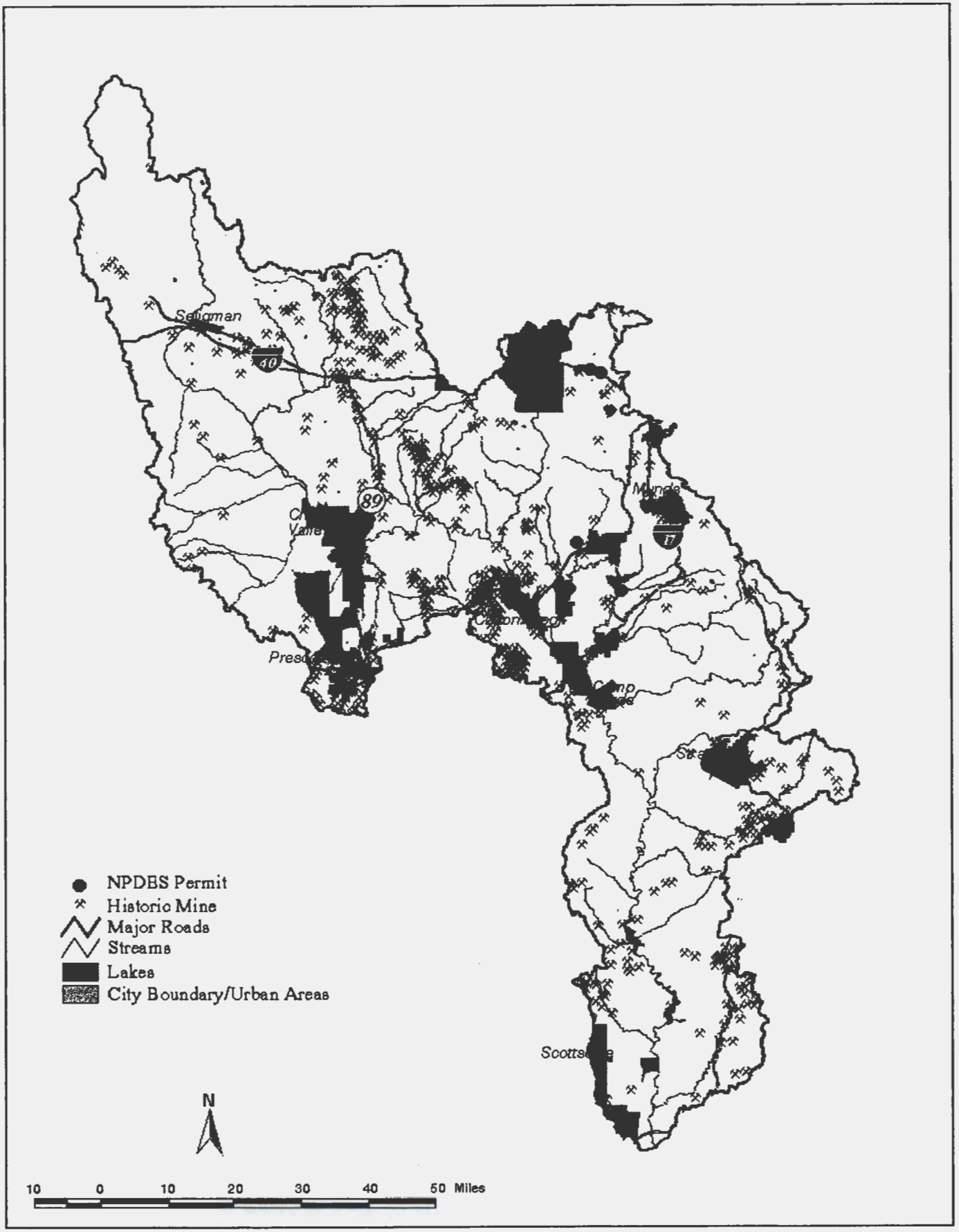

Figure 58. General Land Uses and NPDES Permits in the Verde Watershed

Verde Watershed Assessment Discussion

Statistical Summary of Surface Water Assessments

Assessments – For the 2002 assessment, 493 stream miles and 2,692 lake acres were assessed. This assessment reflects data collected in 1999 when this was the focus watershed for monitoring.

Water quality assessment information for the Verde Watershed is summarized in the following tables and illustrated in **Figure 59**.

Table 30. Assessments in the Verde Watershed – 2002

	STREAMS		LAKES	
	miles	number of segments	acres	number of lakes
ATTAINING	234	14	2,459	5
INCONCLUSIVE	224	18	13	1
IMPAIRED	34	2	0	0
NOT ATTAINING	1	1	220	2
TOTAL ASSESSED	493	35	2,692	8

PERENNIAL SURFACE WATERS ASSESSED		STREAMS		LAKES	
		miles	number of segments	acres	number of lakes
	Assessed	401	27	2,692	8

* Note that streams with significant perennial stretches within the reach assessed were included in the perennial milage although part of the reach may have ephemeral or intermittent flow.

Inconclusive assessments – Surface waters with some monitoring data, but insufficient data to determine if a designated use is attaining or impaired, were added to the new Planning List. During the next watershed monitoring cycle (scheduled in 2004), ADEQ expects to monitor most of these reaches and lakes so that all designated uses can be assessed during the following assessment cycle. Other lakes and streams which lack monitoring data will also be monitored depending on resources and priorities.

ADEQ will be working with US Geological Survey and the Arizona Game and Fish Department, so that their future monitoring efforts will better support Arizona's surface water assessments.

Major stressors – When a surface water is listed as impaired or not attaining a designated use, the pollutants or suspected pollutants causing the impairment are identified. In this watershed, two reaches were assessed as impaired due to turbidity: Beaver Creek and Oak Creek.

Nutrient TMDLs were completed and approved by EPA at two lakes, Peck's Lake and Stoneman Lake to mitigate high pH and low dissolved oxygen levels. A TMDL was also completed for Oak Creek at Slide Rock State Park due to bacterial violations and subsequent swimming area closures. These two lakes and one reach were assessed as "not attaining," and were placed on the Planning List. They will be monitoring to evaluate the effectiveness of TMDL implementation strategies.

Watershed assessment map
97

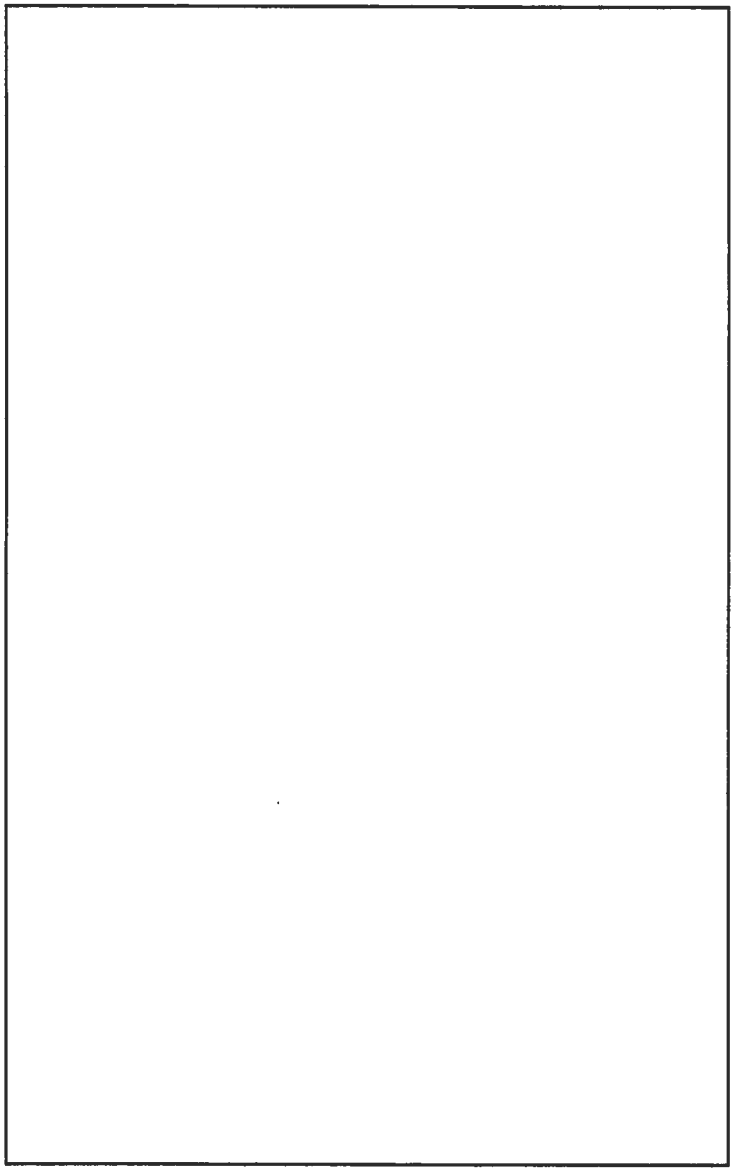

TABLE 31. VERDE WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
STREAM MONITORING DATA								
Apache Creek headwaters-Walnut Creek AZ15060201-019 A&Ww, FC, FBC, AgL	ADEQ Stream Ecosystem Monitoring Near Walnut Creek VRAPA000.1 100189	1997 - 1 suite	OK					Intermittent Stream
	ADEQ Biocriteria Program Above Hunt Tank VRAPA002.46 100715	1996 - 1 suite	OK					
	ADEQ Stream Ecosystem Monitoring Below Apache Springs VRAPA005.2 100190	1997 - 1 suite	OK					
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1996-1997 3 samples 2 sampling events	OK				Inconclusive	ADEQ collected a total of 3 samples from 3 sites in 1996-1997. Reach assessed as "inconclusive" due to insufficient sampling events.
Beaver Creek Dry Beaver Ck.-Verde River AZ15060202-002 A&Wc, FC, FBC, AgL	ADEQ Ambient Monitoring Montezuma's Castle VRBEV002.62 100706	1999 - 1 suite	OK					No bacteria samples.
	ADEQ TMDL Montezuma's Castle VRBEV002.44	1999 - 3 field, nutrients, turbidity 2000 - 2 field, nutrients, turbidity	Turbidity NTU	10 (A&Wc)	2-218	2 of 6		Missing core parameters: bacteria.
	ADEQ Fixed Station Network/TMDL at Camp Verde VRBEV003.64 100496	1997 - 3 field, 1 nutrient 1998 - 4 field 1999 - 1 suite + 4 field 2000 - 2 field, nutrients	Dissolved oxygen mg/l	7.0 (90% saturation) (A&Wc)	5-10.7 (66-104%)	3 of 9		Naturally low dissolved oxygen due to ground water upwelling. These exceedances were not included in the final assessments.
			Turbidity NTU	10 (A&Wc)	12-290	5 of 7		Missing core parameters: bacteria.
	ADEQ Ambient Monitoring Above Verde River VRBEV000.62 100722	1999 - 1 suite	Turbidity NTU	10 (A&Wc)	28	1 of 1		Missing core parameters: bacteria.
	ADEQ TMDL Monitoring at Silt001	1999 - 1 field 2000 - 2 field, nutrients	Turbidity	10 (A&Wc)	2-190	1 of 3		Missing core parameters: bacteria

TABLE 31. VERDE WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ TMDL Monitoring at Foam0001	2000 - 2 field, nutrients	OK					Missing core parameters: bacteria
	ADEQ TMDL Monitoring Eureka Ditch	1999 - 1 field, nutrients 2000 - 2 field, nutrients (no bacterial samples)	Turbidity NTU	10 (A&Wc)	30-101	3 of 3		Missing core parameters: bacteria
	ADEQ Biocriteria Program Above Verde River VRWBV000.58 100496	1997 - 4 field + nutrients 1998 - 1 field + nutrients + 2 field	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.2-9.15 (70-97%)	2 of 7		Missing most core parameters.
	ADEQ TMDL Monitoring above irrigation return	1999 - 1 suite 2000 - 2 field, nutrients (no bacterial samples)	Dissolved oxygen mg/l	7 90% Saturation (A&Wc)	6.6-8.1 71-104%)	1 of 4		Missing core parameters: bacteria
			Turbidity NTU	10 (A&Wc)	1-33	1 of 4		
	Reach Summary Row A&Wc Impaired FC Attaining FBC Inconclusive AgL Attaining	1997-2000 33 samples 20 sampling events Missing core parameters	Dissolved oxygen mg/l	7 90% Saturation (A&Wc)	5-8.1 (66.6-104%)	3 of 33	Attaining	ADEQ collected a total of 26 samples at 9 sites from 1997-2000. Reach assessed as "impaired" due to turbidity. Add to Planning List due to missing core parameters.
			Turbidity NTU	10 (A&Wc)	20-290	13 of 33	Impaired	
Bitter Creek 2.5 miles below WWTP-Verde AZ15060202-066C A&Ww, FC, PBC, AgL	ADEQ Stream Ecosystem Monitoring At confluence with Verde River VRBIT000.1 100191	1997 - 1 suite	OK					
	Reach Summary Row	1997 1 sampling event					Not assessed	Insufficient to data to assess.
Bitter Creek WWTP- 2.5 miles below WWTP AZ15060202-066B A&Wedw, PBC	ADEQ Biocriteria Program 0.5 miles below Jerome WWTP VRBIT002.64 100424	1996 -1 suite	OK					
	ADEQ Stream Ecosystem Monitoring At pet cemetery VRBIT003.1 100192	1997 - 1 suite	OK					

TABLE 31. VERDE WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Stream Ecosystem Monitoring Below Jerome WWTP VRBIT002.72 100193	1997 - 1 suite	OK					
	Reach Summary Row A&Wedw Inconclusive PBC Inconclusive	1996-1997 3 samples 2 sampling events	OK				Inconclusive	ADEQ collected a total of 3 samples at 3 sites. Reach assessed as "inconclusive" due to insufficient sampling events. Analysis considered NPDES permit nutrient waiver.
(Unnamed trib.) to Bitter Creek headwaters-Bitter Creek AZ15060202-868 A&Ww, FC, PBC, AgL	ADEQ Ambient and Biocriteria Unnamed tributary off of Bitter Creek VRUBT000.3 100221	1997- 1 suite	OK					
	Reach Summary Row	1997 1 sampling event	OK				Not assessed	Insufficient to data to assess.
Black Canyon Creek AZ15060202-886 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program Below Gaddes Canyon VRBLA006.03 100418	1996 - 1 suite	OK					Insufficient to data to assess
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient to data to assess.
Camp Creek headwaters-Verde River AZ15060203-031 A&Ww, FC, FBC, DWS, AgI, AgL	ADEQ Biocriteria Program Above Blue Wash confluence VRCMP009.30 100760	1998 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling events	OK				Not assessed	Insufficient to data to assess.
East Verde River headwaters-American Gulch AZ15060203-022A A&Wc, FC, FBC, DWS, AgI, AgL	ADEQ Biocriteria Program Above Brushy Canyon VREVR011.19 100549	1998 -1 suite	OK					
	ADEQ Fixed Station Network below Highway 87 bridge VREVR012.28 100474	1999 - 5 suites 2000 - 4 suites	Beryllium, (total) µg/L	0.21 (FC)	0.55 - 2.6	2 of 2		7 other beryllium samples did not have a low enough Method Detection Limit.
			Dissolved oxygen mg/L	7 (A&Wc)	6.5-11.0	1 of 9		

TABLE 31. VERDE WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Nitrogen (total) mg/L	3 (A&Wc)	0.07- 4.5	1 of 9		
			Phosphorus (total) mg/L	1 (A&Wc)	0.2-1.0	1 of 9		
			Turbidity NTU	10 (A&Wc)	3.07 - 1,000	5 of 9		
	ADEQ Biocriteria Program Below Ellison Creek VREVR015.85 100548	1996 - 1 suite	OK					
	ADEQ Fixed Station Monitoring Above Second Crossing VREVR015.97 100786	1999 - 2 suites	Turbidity NTU	10 (A&Wc)	23 - 53.6	2 of 2		
	ADEQ Biocriteria Program Below Washington Park VREVR018.56 100546	1996 - 1 suite	OK					
	Reach Summary Rpt: A&Wc Inconclusive FC Attaining FBC Attaining DWS Attaining AgI Attaining AgL Attaining	1996-2000 14 samples 12 sampling events	Beryllium (total) µg/L	0.21 (FC)	0.54 - 2.5	2 of 2	Attaining	ADEQ collected a total of 14 samples at 5 sites in 1996-2000. Reach assessed as "attaining some uses" and added to Planning List due to turbidity exceedances.
			Dissolved oxygen mg/L	7 (A&Wc)	6.8-11.0	1 of 13	Attaining	
			Nitrogen (total) mg/l	3 (A&Wc)	0.07- 4.5	1 of 11	Attaining	
			Phosphorus mg/L	1 (A&Wc)	0.2-1.0	1 of 11	Attaining	
			Turbidity NTU	10 (A&Wc)	3.07 - 1,000	7 of 14	Inconclusive	
East Verde River American Gulch-Verde River AZ15060203-022B A&Wc, FC, FBC, DWS, AgI, AgL	USGS Station #09507980 Near Childs VREVR001.42 100739	1996 - 6 suites 1997 - 6 suites 1998 - 5 suites 1999 - 6 suites 2000 - 4 suites	Antimony (total) µg/L	6 (DWS)	1.0-49	4 of 26		Naturally high levels of antimony and arsenic in the ground water. Exceedances occurred when surface water flow is low (below 5 cfs). This occurs when water is not being added to the East Verde River flow from the Little Colorado River drainage. Exceedances not included in the final assessment.
			Arsenic (total) µg/L	50 (DWS)	4.0-170.0	5 of 26		
			Dissolved oxygen mg/L	>7 (A&Wc)	5.8-7.76	1 of 12		Naturally low dissolved oxygen when stream flow is low due to ground water upwelling. These exceedances were not included in the final assessment.

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Turbidity NTU	10 (A&Wc)	0.2-35	2 of 27		
	ADEQ Biocriteria Program Below Pine Creek VREVR008.23 100550	1996 - 1 suite	OK					
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining DWS Attaining AgI Attaining AgL Attaining	1996-2000 28 sampling events	Turbidity NTU	10 (A&Wc)	0.2-35	2 of 27	Attaining	USGS collected 27 samples and ADEQ collected 1 sample in 1996-2000. See comment above concerning antimony and arsenic exceedances. Reach assessed as "attaining all uses."
Ellison Creek headwaters-East Verde River AZ15060203-459 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Above East Verde River VRELL000.12 100543	1996 - 1 suite	OK					Missing core parameters: bacteria
	ADEQ Biocriteria Program Headwaters VRELL004.47 100542	1996 - 1 suite	OK					Missing core parameters: bacteria
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1996 2 samples 1 sampling event Missing core parameters	OK				Inconclusive	ADEQ collected a total of 2 samples at 3 sites in 1996-1997. Assessed as "inconclusive" and added to the Planning list due to lack of sampling events and missing bacteria.
Fossil Creek headwaters-Verde River AZ15060203-024 A&Ww, FC, FBC, AgL	ADEQ Fixed Station Network Above Salley Mae Wash VRFOS005.67 100785	1999 - 2 suites	OK					
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1999 2 sampling events	OK				Inconclusive	ADEQ collected 2 samples in 1999. Reach assessed as "inconclusive" and added to the Planning List due to lack of sampling events.

TABLE 31. VERDE WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Granite Creek headwaters-15060202-060 AZ15060202-059 A&Ww, FC, FBC, AgI, AgL	USGS #09502960 VRGRA004.68	1996 - 1 suite 1999 - 2 suites 2000 - 2 suites	Escherichia coli CFU/100 ml	580 (FBC)	71-8000	1 of 3		Missing core parameters: turbidity, nutrients, many metals.
	ADEQ Fixed Station Network At Sundog Ranch Road VRGRA003.88 100489	1996 - 2 suites	Beryllium (total) µg/L	0.21 (FC)	0.6	1 of 1		One other beryllium sample did not have a low enough method detection limit.
			Escherichia coli CFU/100 ml	580 (FBC)	220-1266	1 of 2		
			Turbidity NTU	50 (A&Ww)	7.44-273	1 of 2		
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	1996-2000 7 sampling events Missing core parameters	Beryllium (total) µg/L	0.21 (FC)	0.6	1 of1	Inconclusive	ADEQ collected a total of 7 samples at 2 sites in 1996-2000. Reach assessed as "inconclusive" and added to the Planning List due to Escherichia coli, beryllium, and turbidity exceedances and missing core parameters.
			Escherichia coli CFU/100 ml	580 (FBC)	220-1266	2 of 5 (exceedances occurred 5 years apart)	Inconclusive	
			Turbidity NTU	50 (A&Ww)	7.44-273	1 of 2	Inconclusive	
Houston Creek headwater-Verde River AZ15060203-041 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program Above Forest Road #6 VRHOU002.75 100761	1996 - 1 suite	OK					No bacterial samples
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Lime Creek headwaters-Horseshoe Res AZ15060203-030 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program 1 mile above Verde VRLIM000.71 100585	1996 - 1 suite	OK					No bacterial or nutrient samples
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Munds Creek headwaters-Oak Creek AZ15060202-415 A&Ww, FC, FBC, DWS, AgI, AgL	ADEQ TMDL Program Above Oak Creek VRMUN000.1	1998 - 3 suites	OK					Missing core parameters: metals, boron. All samples in March, April, and May.
	ADEQ TMDL Program Below Pinewood WWTP VRMUN003.4	1998 - 3 suites	OK					

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ TMDL Program West tributary of Munds Creek Above Pinewood WWTP VRMUN003.5	1997 - 1 suite 1998 - 3 suites	Turbidity NTU	50 (A&Ww)	4-67	1 of 2		
	ADEQ TMDL Program Southeast trib to O'Dell Lake VRMUN004.1	1998 - 2 suites	OK					
	ADEQ TMDL Program Above O'Dell Lake VRMUN004.3	1996 - 3 suites	Turbidity NTU	50 (A&Ww)	5-69	1 of 2		
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive AgL Inconclusive	1997-1998 15 samples 4 sampling events Missing core parameters and seasonal representation	Turbidity NTU	50 (A&Ww)	4-69	2 of 12	Attaining	ADEQ collected a total of 15 samples at 5 sites in 1997-1998. Reach is assessed as "inconclusive" and added to the Planning List due to lack of core parameters and seasonal representation.
Oak Creek headwaters-West Fork Oak Cr. AZ15060202-019 A&Wc, FC, FBC, DWS, AgI, AgL Unique Waters	ADEQ Biocriteria Program Below Cave Springs VROAK023.21 100608	1996 - 1 suite 1998 - 1 suite	OK					No bacteria, beryllium, boron, or mercury. Only 1 cadmium, chromium, and lead, zinc, or fluoride. No mining in the drainage area; therefore, metal samples not required.
	ADEQ TMDL Program Below Pumphouse Wash VROAK025.2	1998 - 3 field + nutrients, bacteria	Turbidity NTU	10 (A&Wc)	1-20	1 of 3		
	ADEQ TMDL Program Above Pumphouse Wash VROAK025.3	1998 - 3 field, nutrients, bacteria	OK					
	AGFD Above Sterling Springs Hatchery	1996 - 1 field, nutrients, bacteria	OK					
	AGFD Below Sterling Springs Hatchery	1996 - 1 field, nutrients, bacteria	OK					
	Reach Summary Row A&Ww Inconclusive FC Attaining FBC Attaining DWS Inconclusive AgI Inconclusive AgL Attaining	1996-1998 9 samples 5 sampling events Missing core parameters	Turbidity NTU	10 (A&Wc)	1-20	1 of 9	Inconclusive	ADEQ and AGFD collected a total of 9 samples at 5 sites in 1996-1998. Reach assessed as "attaining some uses" and added to the Planning List due to turbidity exceedance and missing core parameters (beryllium and boron).

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Oak Creek West Fork Oak Cr.-Dry Creek (except Slide Rock State Park) AZ15060202-018B A&Wc, FC, FBC, DWS, AgI, AgL Unique Water	ADEQ Fixed Station Network At Redrock Crossing VROAK009.33 100492	1996 - 5 suites 1997 - 4 suites 1998 - 4 suites 1999 - 5 suites 2000 - 4 suites	Beryllium (total) µg/L	4.0 (DWS, FBC)	4.1	1 of 20		
			Beryllium (total) µg/L	0.21 (FC)	4.1	1 of 1		Nineteen other beryllium samples did not have a low enough Method Detection Limit.
			Total Nitrogen mg/L	2.5 Unique Waters	0.08-5.0	1 of 21		
			Total Phosphorus mg/L	0.3 Unique Waters	< 0.1 - 1.5	1 of 21		
			Turbidity NTU	10 (A&Wc)	1-1000	3 of 22		
	ADEQ Biocriteria Program At Red Rock State Park VROAK010.29 100612	1996 - 1 suite 1999 - 1 suite	Turbidity NTU	10 (A&Wc)	6-15	1 of 2		
	ADEQ TMDL Program Below Redrock Crossing VROAK011.4	1998 - 3 field + nutrients	OK					
	ADEQ Ambient and Biocriteria At Chavez Crossing VROAK013.11 100461	1996 - 1 suite 1998 - 3 suites	Turbidity NTU	10 (A&Wc)	6-26	1 of 3		
	ADEQ Ambient and Biocriteria At Highway 179 bridge VROAK014.54 100460	1998 - 3 suites	Turbidity NTU	10 (A&Wc)	6-18	1 of 3		
	ADEQ Fixed Station Network below Grasshopper Point VROAK016.57 100459	1996 - 1 suite 1998 - 3 suites	Turbidity NTU	10 (A&Wc)	2-21	1 of 4		
	ADEQ TMDL Program Below Munds Creek VROAK018.1	1998 - 3 suites	Turbidity NTU	10 (A&Wc)	1-30	1 of 3		
	ADEQ TMDL Program Abova Munds Creek VROAK018.3	1998 - 3 suites	Turbidity NTU	10 (A&Wc)	1-22	1 of 3		

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row A&Wc Impaired FC Attaining FBC Attaining DWS Attaining AgI Attaining AgL Attaining	1996 - 2000 44 samples 25 sampling events	Beryllium (total) µg/L	4.0 (DWS, FBC)	< 0.5 - 4.1	1 of 27	Attaining	ADEQ collected a total of 44 samples from 8 sites in 1996-2000. The reach is assessed as" impaired" due to turbidity. (Note change in designated use in new rule package submitted to EPA would bring this reach into compliance with turbidity standard.)
			Beryllium (total) µg/L	0.21 (FC)	4.1	1 of 1	Attaining	
			Total Nitrogen mg/L	2.5 Unique Waters	0.08-5.0	1 of 43	Attaining	
			Total Phosphorus mg/L	0.3 Unique Waters	< 0.1 - 1.5	1 of 43	Attaining	
			Turbidity NTU	10 (A&Wc)	1-1000	9 of 42	Impaired	
Oak Creek At Slide Rock State Park only AZ15060202-018A A&Wc, FC, FBC, DWS, AgI, AgL Unique Water	Slide Rock State Park Routine Bacterial Monitoring Upstream	1996 - 2000 839 *E. coli* samples only	Escherichia coli CFU/100 ml	580 (FBC)	1-2491	20 of 839		No mining in the drainage area: therefore, metal samples not required to assessed designated uses.
	Slide Rock State Park Routine Bacterial Monitoring Midslide	1996 - 2000 778 *E. coli* samples only	Escherichia coli CFU/100 ml	580 (FBC)	1-2491	20 of 778		
	Slide Rock State Park Routine Bacterial Monitoring Large Pool	1996 - 2000 995 *E. coli* samples only	Escherichia coli CFU/100 ml	580 (FBC)	1-2491	16 of 995		
	ADEQ/TMDL Above Slide Rock Foot Bridge VROAK020.02	1998 -1 field (no bacteria)	OK					
	Slide Rock State Park Foot Bridge Routine Bacterial Monitoring	1996 - 2000 712 *E. coli* samples only	Escherichia coli CFU/100 ml	580 (FBC)	1-2491	21 of 712		
	Slide Rock State Park at Highway Bridge Routine Bacterial Monitoring	1996 - 2000 853 *E. coli* samples only	Escherichia coli CFU/100 ml	580 (FBC)	1-2491	22 of 853		
	EPA/ADEQ Biocriteria Program at Slide Rock State Park VROAK019.98 100609	1996 - 1 suite (no bacteria)	OK					
	ADEQ/TMDL Below Slide Rock VROAK020.0	1998 - 1 field (no bacteria)	OK					

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row A&Wc Inconclusive FC Inconclusive FBC Not attaining DWS Inconclusive Agl Inconclusive AgL Inconclusive	1996-2000 3 samples plus 4177 *E. coli* samples Missing core parameters	Escherichia coli CFU/100 ml	580 (FBC)	1-2491	75 of 4177 (more than 2 exceedances in a 3-year period)	Not attaining	ADEQ collected 3 samples at 3 sites in 1996-1998. Slide Rock State Park collected a total of 4177 Escherichia coli samples at 5 sites in 1996-2000. EPA approved TMDLs for pathogens, total phosphorus and total nitrogen in 1999. Reach assessed as "not attaining" due to E. coli exceedances. Add to Planning List for TMDL effectiveness monitoring and insufficient core parameters (fluoride, boron).
Oak Creek Dry Creek-Spring Creek AZ15060202-017 A&Wc, FC, FBC, DWS, Agl, AgL Unique Waters	ADEQ Biocriteria Program Below Page Springs VROAK005.91 100613	1996 - 1 suite (few metals) 1999 - 1 suite	Turbidity NTU	10 (A&Wc)	4-15	1 of 2		
	ADEQ TMDL Program At Page Springs Bridge VROAK006.4	1998 - 1 field, nutrients and turbidity	Turbidity NTU	10 (A&Wc)	45	1 of 1		
	ADEQ Biocriteria Program Above Page Springs VROAK008.49 100614	1996 - 1 suite (few metals)	Turbidity NTU	10 (A&Wc)	1-25	1 of 1		
	Reach Summary Row A&Wc Inconclusive FC Attaining FBC Inconclusive DWS Attaining Agl Inconclusive AgL Attaining	1996-1998 4 samples 3 sampling events Missing core parameters (bacteria and boron)	Turbidity NTU	10 (A&Wc)	1-25	3 of 4	Inconclusive	ADEQ collected a total of 4 samples at 3 sites in 1996-1998. Reach assessed as "attaining some uses" and added to the Planning List due to turbidity exceedances and lack of core parameters.
Oak Creek Spring Creek-Verde River AZ15060202-016 A&Wc, FC, FBC, DWS, Agl, AgL Unique Waters	ADEQ TMDL Program Above Verde River VROAK000.1	1998 - 1 field, nutrients and turbidity	Turbidity NTU	10 (A&Wc)	23	1 of 1		
	ADEQ TMDL Program Above Mormon Crossing VROAK004.9	1998 - 1 field, nutrients and turbidity	OK					
	Reach Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive Agl Inconclusive AgL Inconclusive	1998 2 samples 1 sampling event	Turbidity NTU	10 (A&Wc)	23	1 of 2	Inconclusive	ADEQ collected a total of two samples at two sites in 1998. Assessed as "inconclusive" and added to the Planning List due to lack of sampling events and core parametric coverage.

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Pine Creek headwaters-East Verde River RiverAZ15060203-049 A&Wc, FC, FBC, DWS, AgI, AgL	ADEQ Biocriteria Program Above East Verde River VRPIE000.20 100620	1996 - 1 suite 1997 - 1 suite	OK					Missing core parameters
	ADEQ Biocriteria Program Near headquarters VRPIE013.89 100621	1996 - 1 suite 1997 - 1 suite	OK					Missing core parameters.
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive AgI Inconclusive AgL Inconclusive	1996-1997 4 samples 2 sampling events	OK				Inconclusive	ADEQ collected a total of 4 samples at 2 sites in 1996-1997. Reach assessed as "inconclusive" and added to the Planning List due to lack of sampling events.
Pumphouse Wash headwaters-Oak Creek AZ15060202-442 A&Ww, FC, FBC, DWS, AgI, AgL	ADEQ Fixed Station Network Below Highway 89A bridge VRPMW002.63 100460	1997 - 1 suite 1998 - 1 field	OK					
	ADEQ/TMDL Above Oak Creek VRPMW002.7	1998 - 3 nutrients, field, and bact, 4 turbidity	OK					
	ADEQ/TMDL Below Kachina Village VRPMW007.5	1998 - 3 nutrients, field, turbidity, bact	OK					
	ADEQ/TMDL Above Kachina Village VRPMW008.4	1998 - 2 nutrients, field, turbidity, bact	OK					
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining DWS Inconclusive AgI Inconclusive AgL Attaining	1997-1998 10 samples 5 sampling events Missing core parameters	OK				Inconclusive	ADEQ collected a total of 10 samples at 4 sites in 1997-1998. No mining in the drainage area; therefore, metal samples not required. Reach assessed as "attaining some uses" and added to the Planning List due to insufficient core parameters (fluoride and boron).
Red Creek headwaters-Verde River AZ15060203-818 A&Ww, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Above second road crossing VRRED001.97 100626	1996 - 1 suite	OK					
	Reach Summary Row	1996 1 sampling events					Not assessed	Insufficient to data to assess.

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Roundtree Creek Headwaters-Tangle Creek AZ15060203-853 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program 3 miles above Tangle Creek VRROU001.79 100631	1996 - 1 suite 1998 - 1 suite	OK					
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1996 - 1998 2 sampling events	OK				Inconclusive	ADEQ collected 2 samples in 1996.Reach assessed as "inconclusive" and added to the Planning List due to insufficient sampling events.
Spring Creek Coffee Creek-Oak Creek AZ15060202-022 A&Ww, FC, FBC, AgI, AgL	ADEQ Ambient and Biocriteria At Ryerson Ranch VRSPN001.68 100197	1997 - 1 suite	OK					Missing core parameters: bacteria
	ADEQ Ambient and Biocriteria Above Diversion Dam VRSPN000.48 100195	1997 - 1 suite	OK					
	ADEQ Ambient and Biocriteria Below Mormon Crossing VRSPN001.25 100196	1997 - 1 suite	OK					
	ADEQ Biocriteria Program Near road crossing VRSPN001.36 100650	1996 - 1 suite 1998 - 1 suite	OK					
	ADEQ Ambient and Biocriteria Below Oak Creek Bridge VRSPN000.15 100194	1997 - 1 suite	OK					
	Reach Summary Row A&Ww Attaining FC Attaining FBC Inconclusive AgI Attaining AgL Attaining	1996-1998 6 samples 3 sampling events Missing core parameters	OK				Attaining	ADEQ collected a total of 6 samples at 5 sites from 1996-1998. Reach assessed as "attaining some uses"and added to the Planning List due to insufficient bacterial samples.
Sycamore Creek Tule Canyon-Cedar Creek AZ15060202-026 A&Wc, FC, FBC, AgI, AgL	ADEQ Stream Ecosystem Monitoring Near Verde River VRSYW000.56 100198	1997 - 1 suite (no bacterial samples)	OK					Missing core parameters: bacteria and boron No mining in the drainage area; therefore, metal samples not required.
	ADEQ Ambient and Biocriteria Below Summers Springs VRSYW001.4 100199	1996 - 1 field 1997 - 1 field plus metals 1998 - 1 suite (No bacterial samples)	OK					Missing core parameters: bacteria. (Turbidity boron and nitrogen missing except in 1 sample). No mining in the drainage area; therefore, metal samples not required.

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row A&Wc Inconclusive FC Attaining FBC Inconclusive AgL Attaining Agl Inconclusive	1996-1998 4 sampling events Missing core parameters	OK				Inconclusive	ADEQ collected a total of 3 samples at 2 sites in 1996-1998; sites close together so assessed as one site. Reach assessed as "attaining some uses" and added to the Planning List due to missing core parameters.
Sycamore Creek headwaters-Verde River AZ15060203-055 A&Ww, FC, FBC, Agl, AgL	ADEQ Biocriteria Program Tributary of Horseshoe Res. VRSYH000.16 100656	1996 - 1 suite 1998 - 1 suite	OK					Missing core parameters: bacteria
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	1996-1998 2 sampling events	OK				Inconclusive	ADEQ collected 2 samples in 1996-1998. Reach assessed as "inconclusive" and added to the Planning List due to lack of sampling events.
Sycamore Creek headwaters-Verde River AZ15060203-002 A&Ww, FC, FBC, Agl, AgL	ADEQ Biocriteria Program in Mazatzal Mountains VRSYM012.45 100659	1996 - 1 suite	OK					
	Reach Summary Row	1996 1 sampling event	OK				Not assessed.	Insufficient to data to assess.
Tangle Creek headwaters-Verde River AZ15060203-028 A&Ww, FC, FBC, Agl, AgL	ADEQ Biocriteria Program Near Tangle Peak VRTGL000.78 100666	1996 - 1 suite	Ok					
	Reach Summary Row	1996 1 sampling event	OK				Inconclusive	Insufficient to data to assess.
Verde River Granite Creek-Hell Canyon AZ15060202-052 A&Ww, FC, FBC, Agl, AgL	ADEQ Biocriteria Program East of Paulden VRVER095.73 100764	1996 - 1 suite 1998 - 1 suite	OK					
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive Agl Inconclusive	1996 - 1998 2 sampling events	OK				Inconclusive	ADEQ collected a total of 2 samples in 1996-1998. Reach assessed as "inconclusive" and added to the Planning List due to insufficient sampling events.

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Verde River Hell Canyon-15060202-065 AZ15060202-038 A&Ww, FC, FBC, AgI, AgL	ADEQ Ambient and Biocriteria Above Perkinsville bridge VRVER095.54 100672	1996 - 1 field 1999 - 1 suite	OK					Missing core parameters: bacteria
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive AgI Inconclusive	1996 - 1999 2 sampling events Missing core parameters	OK				Inconclusive	ADEQ collected a total of 2 samples in 1996 - 1999. Reach assessed as "inconclusive"and added to the Planning List due to insufficient sampling events and lack of bacteria samples.
Verde River 15060202-065-Railroad Draw AZ15060202-037 A&Ww, FC, FBC, AgI, AgL	ADEQ Fixed Station Network Below Perkinsville Bridge VRVER095.65 100487	1996 - 3 suites + 2 field 1999 - 6 suites 2000 - 4 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.72 - 11.1 (74-122 %)	1 of 14		
			Escherichia coli CFU/100 ml	580 (FBC)	2 - 2,300	1 of 13		
			Fecal coliform CFU/100 ml	4,000 (A&Ww, AgI, AgL)	1 - 4,500	1 of 12		
			Turbidity NTU	50 (A&Ww)	1 - 677	4 of 15		
	Reach Summary Row A&Ww Inconclusive FC Attaining FBC Attaining AgI Attaining AgL Attaining	1996-2000 15 samples 15 sampling events	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.72-11.1 (75-122%)	1 of 15	Attaining	ADEQ collected a total of 15 samples in 1996 - 1999. Reach assessed as "attaining some uses" and added to the Planning List due to turbidity exceedances.
			Escherichia coli CFU/100 ml	580 (FBC)	2 - 2,300	1 of 13	Attaining	
			Fecal coliform CFU/100 ml	4,000 (A&Ww, AgI, AgL)	1 - 4,500	1 of 12	Attaining	
			Turbidity NTU	50 (A&Ww)	1 - 677	4 of 15	Inconclusive	
Verde River Sycamore Creek-Oak Creek AZ15060202-025 A&Ww, FC, FBC, AgI, AgL	USGS/TMDL Above Dead Horse State Park VRVER084.38	1999 - 1 suite	OK					
	ADEQ Ambient and Biocriteria At Dead Horse State Park VRVER84.38 100482	1999 - 2 suites	OK					
	USGS/TMDL Below Dead Horse State Park VRVER084.42	1999 - 1 suite	OK					

TABLE 31. VERDE WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	USGS/TMDL At Tuzigoot Bridge VRVER085.49	1999 - 1 suite	OK					
	USGS/TMDL At sewage pond VRVER085.81	1999 - 1 suite	OK					
	USGS/TMDL Above sewage pond VRVER085.92 344615 112023501	1999 - 1 suite	OK					
	USGS/TMDL Below diversion dam VRVER086.62	1999 - 1 suite	OK					
	USGS/TMDL Below Tapco Substation VRVER087.70	1999 - 1 suite	OK					
	USGS Station #09504000 Near Clarkdale VRVER091.61 100738	1996 - 6 suites 1997 - 6 suites 1998 - 6 suites 1999 - 4 suites 2000 - 4 suites	OK					
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining AgI Attaining AgL Attaining	1996 - 2000 34 samples 28 sampling events	OK				Attaining	ADEQ collected a total of 33 samples at 8 sites in 1996 -2000. Reach assessed as "attaining all uses."
Verde River Oak Creek-Beaver Creek AZ15060202-015 A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Program Across from Reservation VRVER075.14 100718	1999 - 1 suite	OK					No bacterial samples.
	ADEQ Biocriteria & TMDL At 1000 Trails VRVER078.76 100481	1996 - 1 suite 1999 - 1 suite	OK					No bacterial samples
	ADEQ TMDL Program Below Oak Creek VRVER078.8	1998 - 1field, nutrient	OK					Lacking core parametric coverage
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	1996 - 1999 4 samples 3 sampling events Missing core parameters at 1 event	OK				Inconclusive	ADEQ collected a total of 4 samples at 3 sites 1996-1999. Reach assessed as "inconclusive" and added to the Planning List due to missing core parameters at one of the three sampling events.

TABLE 31. VERDE WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Verde River 15060203-West Clear Creek AZ15060203-027 A&Ww, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Above West Clear Creek VRVER066.74 100723	1998 - 1 suite 1999 - 1 suite	OK					No bacterial samples.
	USGS #09505570 Above West Clear Creek VRVER066.64 100750	1996 - 10 suites 1997 - 5 suites 1998 - 6 suites	OK					No bacterial samples.
	Reach Summary Row A&Ww Attaining FC Attaining FBC Inconclusive AgI Attaining AgL Attaining	1996 - 1999 23 sampling events - Missing core parameters (bacteria)	OK				Attaining	ADEQ and USGS collected at total of 25 samples at 2 sites 1996-1999. Reach assessed as "attaining some uses" and added to the Planning List due to missing core parameters.
Verde River West Clear Creek-Fossil Creek AZ15060203-025 A&Ww, FC, FBC, AgI, AgL	ADEQ Fixed Station Program At Beasley Flat VRVER064.68 100477	1999 - 4 suites 2000 - 4 suites	Escherichia coli CFU/100 ml	580 (FBC)	<2- 1,125	1 of 8		
			Turbidity NTU	50 (A&Ww)	7-998	3 of 8		
	USGS TMDL At Beasley Flat VRVER064.68	1999 - 1 suite	Turbidity NTU	50 (A&Ww)	77	1 of 1		
	Reach Summary Row A&Ww Inconclusive FC Attaining FBC Inconclusive AgI Attaining AgL Attaining	1999 - 2000 9 samples	Escherichia coli CFU/100 ml	580 (FBC)	<2- 1,125	1 of 9	Inconclusive	ADEQ and USGS collected a total of 9 samples at 2 sites 1999-2000. Reach assessed as "attaining some uses" and added to the Planning List due to E. coli and turbidity exceedances.
			Turbidity NTU	50 (A&Ww)	1-998	4 of 9	Inconclusive	
Verde River Tangle Creek-Ister Flat AZ15060203-016 A&Ww, FC, FBC, AgI, AgL	USGS Station #09508500 Below Tangle Creek VRVER036.48 100740	1996 - 8 suites 1997 - 15 suites 1998 - 6 suites 1999 - 6 suites 2000 - 4 suites	*Escherichia coli* CFU/100 mg/L	580 (FBC)	<1.0-770	1 of 13		
			Turbidity NTU	50 (A&Ww)	0.3-170	4 of 14		
	SRP Routine Monitoring Below Tangle Creek	2000 - 11 suites	OK					Missing core parameters: bacteria, nutrients, nitrates, turbidity, dissolved oxygen, flow, some metals, beryllium, fluoride, barium, boron, pH.
	ADEQ Biocriteria Program Above Sheep Bridge VRVER036.65 100678	1999 - 1 suite	OK					Missing core parameters: bacteria

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row A&Ww Inconclusive FC Attaining FBC Attaining DWS Attaining AgI Attaining AgL Attaining	1996 - 2000 51 sampling events	*Escherichia coli* CFU/100 mg/L	580 (FBC)	<1.0-770	1 of 13	Attaining	ADEQ, USGS, and SRP collected a total of 105 samples in 1996-2000 at 4 sites. Reach is assessed as "attaining some uses" and added to the Planning List due to turbidity exceedances.
			Turbidity NTU	50 (A&Ww)	0.3-170	4 of 15	Inconclusive	
Verde River Horseshoe Lake-Bartlett Lake AZ15060203-008 A&Ww, FC, FBC, AgI, AgL	ADEQ Fixed Station Monitoring Below Horseshoe Lake VEVER027.54 100831	1999 - 1 suite	OK					
	Reach Summary Row	1999 1 sampling event	OK				Not assessed	Insufficient samples to assess.
Verde River Bartlett Dam-Camp Creek AZ15060203-004 A&Ww, FC, FBC, DWS, AgI, AgL	SRP Routine Monitoring Below Bartlett Dam VRVER017.55	1996 - 12 suites 1997 - 12 suites 1998 - 7 suites 1999 - 13 suites 2000 - 12 suites	OK					Missing core parameters: bacteria, flow, fluoride, barium, beryllium. some metals, pH, dissolved oxygen, turbidity.
	USGS Station #09510000 Below Bartlett Dam 100741	1999 - 3 suites 2000 - 6 suites	OK					Missing core parameters: bacteria
	Reach Summary Row A&Ww Attaining FC Attaining FBC Inconclusive DWS Attaining AgI Attaining AgL Attaining	1996 - 2000 65 sampling events Missing bacteria samples	OK				Attaining	ADEQ, USGS, and SRP collected a total of 105 samples in 1996-2000 at 4 sites. Reach is assessed as "attaining some uses" and added to the Planning List due to missing bacteria samples.
Walnut Creek Apache Creek-Big Chino Wash AZ15060201-017 A&Ww, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Above Road 95 VRWAL011.07 100681	1996 - 1 suite	OK					Need more data to assess. Natually low dissolved oxygen during low flows.
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Webber Creek headwaters-East Verde River AZ15060203-058 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Below Geronimo Scout Camp VRWEB006.03 100690	1996 - 1 suite 1997 - 1 suite	OK					Need more data to assess.
	Reach Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1996-1997 2 sampling events	OK				Inconclusive	ADEQ collected 2 samples in 1996-1997. Reach assessed as "inconclusive" and added to the Planning List due to lack of sampling events.
West Clear Creek headwaters-Verde River AZ15060203-026 A&Wc, FC, FBC, AgL	ADEQ Stream Ecosystem Above diversion VRWCL000.94 100200	1997 - 1 suite	Turbidity NTU	10 (A&Wc)	24	1 of 1		Missing core parameters: bacterial samples.
	ADEQ Stream Ecosystem above lower campground VRWCL002.66 100201	1997 - 1 suite	OK					Missing core parameters: bacterial samples.
	ADEQ Biocriteria Program At campground VRWCL002.91 100689	1996 - 1 suite 1999 - 1 suite	OK					Missing core parameters: bacterial samples.
	ADEQ Stream Ecosystem SW of Cactus Mountain VRWCL003.19 100202	1997 - 1 suite	OK					Missing core parameters: bacterial samples
	ADEQ Stream Ecosystem Below Bull Pen Ranch VRWCL004.93 100203	1997 - 1 suite	OK					Missing core parameters: bacterial samples
	USGS #09505800 Near Camp Verde VRWCL005.79 100749	1996 - 8 suites 1997 - 12 suites 1998 - 16 suites 1999 - 12 suites 2000 - 6 suites						Missing core parameters: turbidity, nitrogen, most metals, bacterial samples.
	ADEQ Biocriteria Program Above Bull Pen Ranch VRWCL006.09 100204	1997 - 1 suite 1998 - 1 suite 1999 - 1 suite	OK					Missing core parameters: bacterial samples.
	ADEQ Biocriteria Program At Callaway Butte VRWCL012.50 100687	1996 - 1 suite	OK					Missing core parameters: bacterial samples.

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Biocriteria Program At Maxwell Trail (upper) VRWCL0016.84 100205	1996 - 1 suite 1997 - 2 suites	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.9 - 8.1	1 of 3		Natural low dissolved oxygen due to ground water upwelling and low flow. This exceedance was not included in the final assessment. Missing core parameters: bacteria.
	Reach Summary Row A&Wc Attaining FC Attaining FBC Inconclusive AgL Attaining	1996-2000 66 samples 58 sampling events Missing core parameters	Turbidity (NTU)	10 (A&Wc)	1-24	1 of 12	Attaining	ADEQ and USGS collected a total of 66 samples at 7 site in 1996-2000. Reach assessed as "attaining some uses" and added to the Planning List due to lack of bacteria samples.
West Fork Oak Creek headwaters-Oak Creek AZ15060202-020 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Above Fourth Trail Crossing VRWOK000.64 100693	1996 - 1 suite 1998 - 1 suite	OK					
	Reach Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1996-1998 2 sampling events	OK				Inconclusive	ADEQ collected 2 samples in 1996-1998. Reach assessed as "inconclusive" and added to the Planning List due to insufficient sampling events.
Wet Beaver Creek Long Canyon-Rarick AZ15060202-004 A&Wc, FC, FBC, AgI, AgL	ADEQ TMDL Program At Montezuma Well VRWBV003.18	1999 - 1 field, nutrients, turbidity 2000 - 2 field, nutrients, turbidity	OK					Missing core parameters
	ADEQ TMDL Program At camp ground VRBEV004.95	1999 - 1 field, nutrients, turbidity 2000 - 2 field, nutrients, turbidity	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.7-9.4 (86.9-93.3%)	1 of 3		Missing core parameters
	ADEQ Biocriteria Program At campground VRWBV005.06 100684	1999 - 1 suite	OK					Missing core parameters: bacteria.
	ADEQ Biocriteria &TMDL Above USGS gage at Rimrock VRWBV006.79 100765	1998 - 1 suite 1999 - 1 suite 2000 - 2 field, nutrients, turbidity	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.65 (75.2%)	1 of 1		Missing core parameters: no bacterial samples, only 1 beryllium, boron, manganese, chromium, zinc, mercury, arsenic, lead.
	Reach Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	1998 - 2000 11 samples 4 sampling events Missing core parameters	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.65-9.4 (75.2 -101%)	1 of 11	Attaining	ADEQ collected a total of 11 samples at 5 sites in 1998-2000. Reach assessed as "inconclusive" due to insufficient core parametric coverage

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Wet Bottom Creek headwaters-Verde River AZ15060203-020 A&Ww, FC, FBC, AgI, AgL	USGS Station #09508300 Near Childs VRWET000.94 100777	1996 - 2 field	OK					Not perennial stream flow
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1996 2 sampling events	OK				Inconclusive	USGS collected 2 field samples in 1996. Reach assessed as "inconclusive" due to insufficient sampling events and core parametric coverage.
LAKE MONITORING DATA								
Bartlett Lake AZL15060203-0110 A&Ww, FC, FBC, DWS, AgI, AgL	ADEQ Lakes Program VRBAR-A 100009	1996 - 1 suite 1997 - 3 suites 1998 - 4 suites 1999 - 2 suites 2000 - 1 suite, 1 field	OK					Missing core parameters: bacteria
	ADEQ Lakes Program VRBAR-B 100010	1996 - 2 field 1997 - 2 suites 1998 - 3 suites 1999 - 1 suite, 1 field 2000 - 1 field	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.7-12.2 (63-130%)	1 of 8		
	ADEQ Lakes Program VRBAR-C 100011	1996 - 1 suite 1997 - 2 suites 1998 - 3 suites 1999 - 4 suites 2000 - 2 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.9-11.5	1 of 7		
			Turbidity NTU	25 (A&Ww)	3-28	1 of 7		This turbidity exceedance was due to an upstream dam release; therefore, it is excluded in the final assessment (R18-11-118).
	ADEQ Lakes Program VRBAR-NTU1 100980	1999 - 1 turbidity	OK					Missing core parameters: bacteria.
	ADEQ Lakes Program VRBAR-NTU2 100981	1999 - 1 turbidity	OK					
	ADEQ Lakes Program VRBAR-NTU3 100982	1999 - 2 field, turbidity 2000 - 2 suites	OK					
	ADEQ Lakes Program VRBAR-NTU4 100983	1999 - 2 field, 3 turbidity 2000 - 1 suite	OK					
	ADEQ Lakes Program VRBAR-NTU5 100984	1999 - 1 field	OK					

TABLE 31. VERDE WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row A&Ww Attaining FC Attaining FBC Inconclusive DWS Attaining AgI Attaining AgL Attaining	1996-2000 44 samples 12 sampling events Missing core parameters	Dissolved oxygen mg/L	5.0 (90% saturation) (A&Ww)	5.68-12.19	2 of 23	Attaining	ADEQ collected a total of 44 samples at 8 sites in 1996-2000. Lake is assessed as "attaining some uses" and added to the Planning List due to missing core parameters (bacteria).
Granite Basin Lake AZL15060202-0580 A&Ww, FC, FBC, AgI, AgL	ADEQ Lakes Program VRGBL - A 100024	1997 - 4 suites 1999 - 3 suites 2000 - 1 suite	Arsenic (total) µg/L	50 (FBC)	<10-69	1 of 7		Median result of all samples on the date with a recorded exceedance was <10; therefore, exceedance was not included in the final assessment.
			Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.25-15.45 (49%-159%)	3 of 7		Depth for lead was 1.75 meters.
			Lead (total) µg/L	100 (AgL) 10,000 (AgI)	5-23,000	1 of 8		Median result of all samples on the date with a recorded exceedance was <10; therefore, exceedance was not included in the final assessment.
			Manganese µg/L	10, 000 (AgI)	<50-12,000	1 of 8		Median result of all samples on the date with a recorded exceedance was <10; therefore, exceedance was not included in the final assessment.
	ADEQ Lakes Program VRGBL - B 100025	1999 - 3 suites 2000 - 1 suite	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	3.14-10.24 (45%-127.5%)	1 of 3		
			pH (high) SU	6.5-9.0 (A&Ww, FBC, AgL) 4.5-9.0 (AgI)	7.1-9.5	1 of 4		
	Reach Summary Row A&Ww Inconclusive FC Attaining FBC Inconclusive AgI Inconclusive AgL Inconclusive	1997-2000 8 sampling events Missing core parameters	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.25-15.45 (49%-159%)	3 of 7	Inconclusive	ADEQ collected a total of 8 samples at 2 sites in 1997-2000. Lake assessed as "attaining some uses"and added to the Planning List due to exceedances of dissolved oxygen and pH and insufficient parametric coverage (beryllium, turbidity, bacteria)
			pH (high) SU	6.5-9.0 (A&Ww, FBC, AgL) 4.5-9.0 (AgI)	7.1-9.5	1 of 8	Inconclusive	
Green Valley Lake AZL15060203-0015 A&Ww, FC, PBC	AGFD Routine Monitoring VRGRE - site 1	1997 - 1 field and nutrients	pH (high) SU	>6.5-<9.0 (A&Ww, PBC)	9.46	1 of 1		
	AGFD Routine Monitoring VRGRE - site 2	1997 - 1 field and nutrients	pH (high) SU	>6.5-<9.0 (A&Ww, PBC)	9.45	1 of 1		
	Reach Summary Row A&Ww Inconclusive FC Inconclusive PBC Inconclusive	1997 2 samples 1 sampling event	pH (high) SU	>6.5-<9.0 (A&Ww, PBC)	9.45-9.46	2 of 2	Inconclusive	AGFD collected a total of 2 field samples at 2 sites in 1997. Lake assessed as "inconclusive"and added to the Planning List due to pH exceedance, lack of sampling events, and core parameters.

TABLE 31. VERDE WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Horseshoe Reservoir AZL15060203-0620 A&Ww, FC, FBC, AgI, AgL	ADEQ Clean Lakes Program VRHSR	1997 - 1 suite	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.73-5.86 (62.7-65.8%)	1 of 1		
	Reach Summary Row	1997 1 sampling event	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.73-5.86 (62.7-65.8%)	1 of 1	Not assessed	Insufficient data to assess. Add to Planning List due to dissolved oxygen.
Pecks Lake AZL15060202-1060 A&Wc, FC, FBC, AgI, AgL	ADEQ Lakes Program VRPEC-A 100063	1997 - 4 suites 1999 - 3 suites 2000 - 2 suites	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4.0-11.7	3 of 8		Missing core parameters: bacteria
			Mercury (total) µg/L	0.6 (FC)	<0.5-0.9	1 of 8		Median result did not exceed standard.
			pH (high) SU	8.5-9.0 (A&Wc, FBC, AgI)	6.8-9.7	2 of 8		
	ADEQ Lakes Program VRPEC-AA 100511	1999 - 1 suite 2000 - 1 suite	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	2.03 - 8.26 (18-85% sat.)	1 of 2		Missing core parameters: bacteria
	ADEQ Lakes Program VRPEC-F 1005113	1999 - 2 suites	OK					
	Reach Summary Row A&Wc Not attaining FC Attaining FBC Inconclusive AgI Attaining AgL Attaining	1999-2000 12 sampling events Missing core parameters	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	2-11.7	4 of 12	Not attaining	ADEQ collected a total of 12 samples at 3 sites in 1997-2000. Reach assessed as "not attaining" due to EPA approval of a DO and pH TMDL in 2000. Added to Planning List for effectiveness monitoring.
			pH (high) SU	8.5-9.0 (A&Wc, FBC, AgI)	6.8-9.7	2 of 12	Attaining (TMDL approved)	
Stehr Lake AZL15060203-1480 A&Ww, FC, FBC, AgL	ADEQ Lakes Program VRSTH-A 100085	1996 - 1 suite 1997 - 3 suites	OK					Missing core parameters: bacteria, nitrogen
	Reach Summary Row A&Ww Inconclusive FC Attaining FBC Inconclusive AgL Attaining	1996-1997 4 sampling events Missing core parameters	OK				Attaining	ADEQ collected a total of 3 samples in 1997. Lake assessed as "attaining some uses" due to missing core parameters.
Stoneman Lake AZL15060202-1490 A&Wc, FC, FBC, AgI, AgL	ADEQ Lakes Program VRSTN-A 100086	1996 - 1 suite 1997 - 3 suites 1999 - 4 suites	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4.5-13.9 (62.7-106%)	1 of 8		Missing core parameters: bacteria
			pH SU	6.5-9.0 (A&Wc, FBC, AgI, AgL)	6.82-9.9	3 of 7		
	ADEQ Lakes Program VRSTN-B 100698	1999 - 3 suites	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.7 (82%)	1 of 3		May be naturally low dissolved oxygen due to ground water recharge.
			pH SU	6.5-9.0 (A&Wc, FBC, AgI, AgL)	8.81 - 9.62	1 of 3		Missing core parameters: bacteria

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row A&Wc Not attaining FC Attaining FBC Not attaining Agl Not attaining AgL Not attaining	1996-1999 8 sampling events (Sample results were combined due to close proximity) Missing core parameters	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4.5-13.9 (85-106%)	1 of 8	Not attaining	ADEQ collected a total of 8 samples at 2 sites in 1996-1999. Lake assessed as "not attaining" due to dissolved oxygen, pH, narrative nutrient. TMDL completed 2000. Add to Planning list for effectiveness monitoring and missing core parameters.
			pH SU	6.5-9.0 (A&Wc, FBC, Agl, AgL)	8.9 - 9.8	3 of 7	Not attaining	
Sullivan Lake AZL15060202-3370 A&Ww, FC, FBC, Agl, AgL	ADEQ Clean Lakes Program VRSUL-A 100068	1997 - 3 suites	pH (high) SU	>6.5-<9.0 (A&Ww, FBC, Agl, AgL)	8.4-9.7	1 of 3		Lake is silted to top of dam. Missing core parameters: nutrients, bacteria, beryllium
	Reach Summary Row A&Ww Inconclusive FC Attaining FBC Inconclusive Agl Attaining AgL Attaining	1997 3 samples	pH (high) SU	>6.5-<9.0 (A&Ww, FBC, Agl, AgL)	8.4-9.7	1 of 3	Inconclusive	ADEQ collected a total of 3 samples in 1997. Lake assessed as "attaining some uses" and added to the Planning List due to pH exceedance and missing core parameters.
Whitehorse Lake AZL15060202-1630 A&Wc, FC, FBC, DWS, Agl, AgL	ADEQ Lakes Program VRWHH - A 100090	1997 - 4 suites 1999 - 2 suites 2000 - 3 suites	Dissolved oxygen mg/L	>7.0 (90% saturation) (A&Wc)	0.59-10.4 (0.06-145%)	4 of 8		Missing core parameters: bacteria
			pH SU	6.5-9.0 (A&Wc, FBC, AgL) 4.5-9.0 (Agl) 5.0-9.0 (DWS)	6.15-9.6 (7.0)	2 of 9 1 of 9 1 of 9		
			Turbidity NTU	10 (A&Wc)	39	8 of 8		Laboratory values used instead of field results
	ADEQ Lakes Program VRWHH-B 100724	1999 - 2 field, nutrients 2000 - 1 field	Dissolved oxygen mg/L	>7.0 (90% saturation) (A&Wc)	5.75-9.98 (73%-148%)	1 of 3		Missing core parameters: bacteria
			pH SU	6.5-9.0 (A&Wc, FBC, AgL) 4.5-9.0 (Agl) 5.0-9.0 (DWS)	7.1-9.6	1 of 3 1 of 3		
			Turbidity NTU	10 (A&Wc)	13-56	11 of 11		Laboratory values used instead of field results
	Reach Summary Row A&Ww Inconclusive FC Attaining FBC Inconclusive DWS Attaining Agl Attaining AgL Inconclusive	1999-2000 12 samples 3 sampling events Missing core parameters	Dissolved oxygen mg/L	>7.0 (90% saturation) (A&Wc)	5.75-9.98 (73%-148%)	5 of 11	Inconclusive	ADEQ collected a total of 12 samples at 2 sites from1997-2000. Lake is assessed as "attaining some uses" and added to the Planning List due to dissolved oxygen, pH, and turbidity exceedances and missing core parameters.
			pH (High)	6.5-9.0 (A&Wc, FBC, AgL) 4.5-9.0 (Agl) 5.0-9.0 (DWS)	8.2-9.5	3 of 12 1 of 12 1 of 12	Inconclusive	
			Turbidity NTU	10 (A&Wc)	13-56	11 of 11	Inconclusive	

Information for interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from using AZ (for streams) or AZL (for lakes) + Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses", "Agency", and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" -- This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" -- The year and number of water samples is shown. The federal "water year is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
  - "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among samples as many different programs and agencies provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
  - "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
  - If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters
- "Standards Exceeded at this Site per Sampling Event."
  - Although many parameters may be analyzed, only those exceeding a standard are shown.
  - "OK" indicates that no standards were exceeded.
  - The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
  - "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
  - A mean or geometric mean will be shown along with the range of results if applicable to the standard.
- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or " Inconclusive." See assessment criteria in Chapter III of Volume I.

Ground Water Assessments in the Verde Watershed

Major ground water stressors -- Monitoring data collected from wells in this watershed between October 1995-October 2000 are summarized in **Table 32** and illustrated in **Figures 60, 61, and 62.** Wells are sampled for different constituents and samples were not collected uniformly across the watershed but were collected generally as part of a special study.

Of the 118 wells monitored, few exceeded standards for radiochemicals, fluoride, metals, or nitrate. No wells exceeded pesticide standards although the Verde Valley has had extensive agricultural crop production. The location of the wells monitored and the wells exceeding standards is illustrated in **Figure 60**. Volatile organic chemicals (VOCs) exceeded standards in the Payson area. These samples were collected as part of the Superfund remediation site investigation which is described in the final section of this watershed report.

TDS concentrations -- Water quality can be characterized based on concentration of Total Dissolved Solids (TDS). High levels of salinity can limit the practical uses of ground water, as TDS over 500 mg/L has an off-flavor, and TDS over 1000 mg/L will limit its use for some crops. As indicated in **Table 32** and illustrated in **Figure 61**, TDS does not appear to be generally elevated in this watershed; however, TDS testing was concentrated in only one region.

No TDS water quality standards apply in this watershed, as elevated levels of TDS do not present a human-health concern for drinking water. The TDS concentration is only used to generally characterize water quality. In the Verde Watershed, the lack of elevated TDS would indicate excellent ground water quality.

Nitrate concentrations -- Water quality can also be characterized by looking at the concentration of nitrates in ground water. In Arizona, natural occurring nitrate concentrations in ground water are generally below 3 mg/L and concentrations above 5 mg/L indicate potential anthropogenic sources of nitrates. Of the 90 tested for nitrate concentration, 17 wells (19%) exceeded this level. As illustrated in **Figure 62**, elevated nitrates occur in the Payson area and north of Prescott. Irrigated agriculture, septic systems, and other wastewater disposal facilities are may be sources of this nitrate.

When nitrate concentrations exceed 10 mg/L, Arizona's Aquifer Water Quality Standard has been exceeded. This standard was set to protect human health ,as water with nitrate greater than 10 mg/L may present a health problem for infants and should not be consumed by nursing mothers. Only two wells in the Payson area exceeded this level. As many of the wells sampled are irrigation wells (not used for drinking water), nitrates over 10 mg/L may not represent a human-health concern in this watershed. However, efforts should be made to minimize further contamination of ground water by nitrate.

Table 32. Verde Watershed Ground Water Monitoring 1996 - 2000

MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	9		1	11%
	Fluoride	41		2	5%
	Metals/Metaloids	42		2	5%
	Nitrate	42		0	0%
	VOCs + SVOCs*	2	1	0	0%
	Pesticides	2	0	0	0%
TARGETED MONITORING WELLS	Radiochemicals	3		0	0%
	Fluoride	17		0	0%
	Metals/metaloids	52		0	0%
	Nitrate	48		2	4%
	VOCs + SVOCs*	76	46	32	42%
	Pesticides	75	0	0	0%

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
55	43	3	0	0

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
90	73	15	2

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.
*The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.

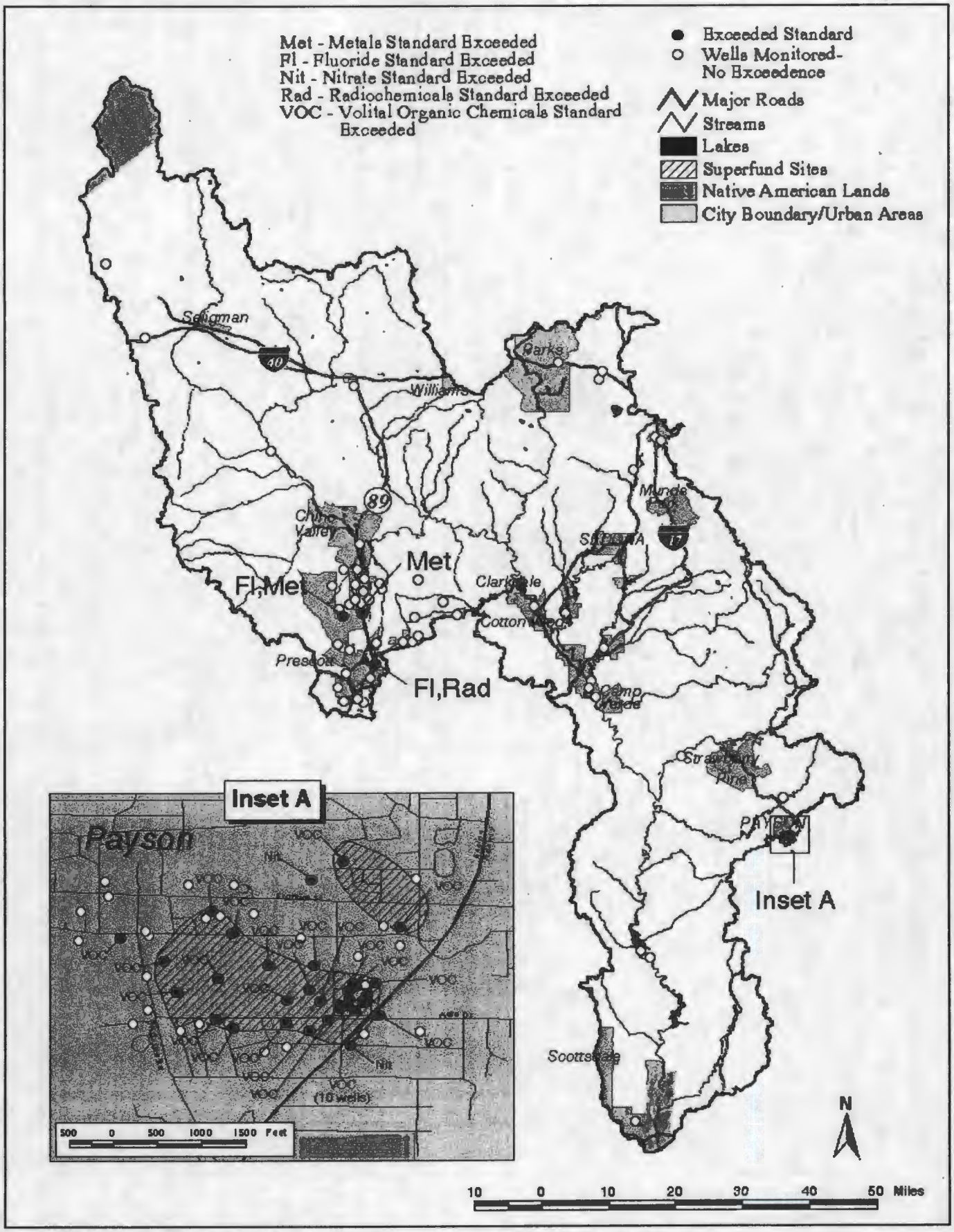

Figure 60. Ground Water Monitoring in the Verde Watershed – 1995-2000

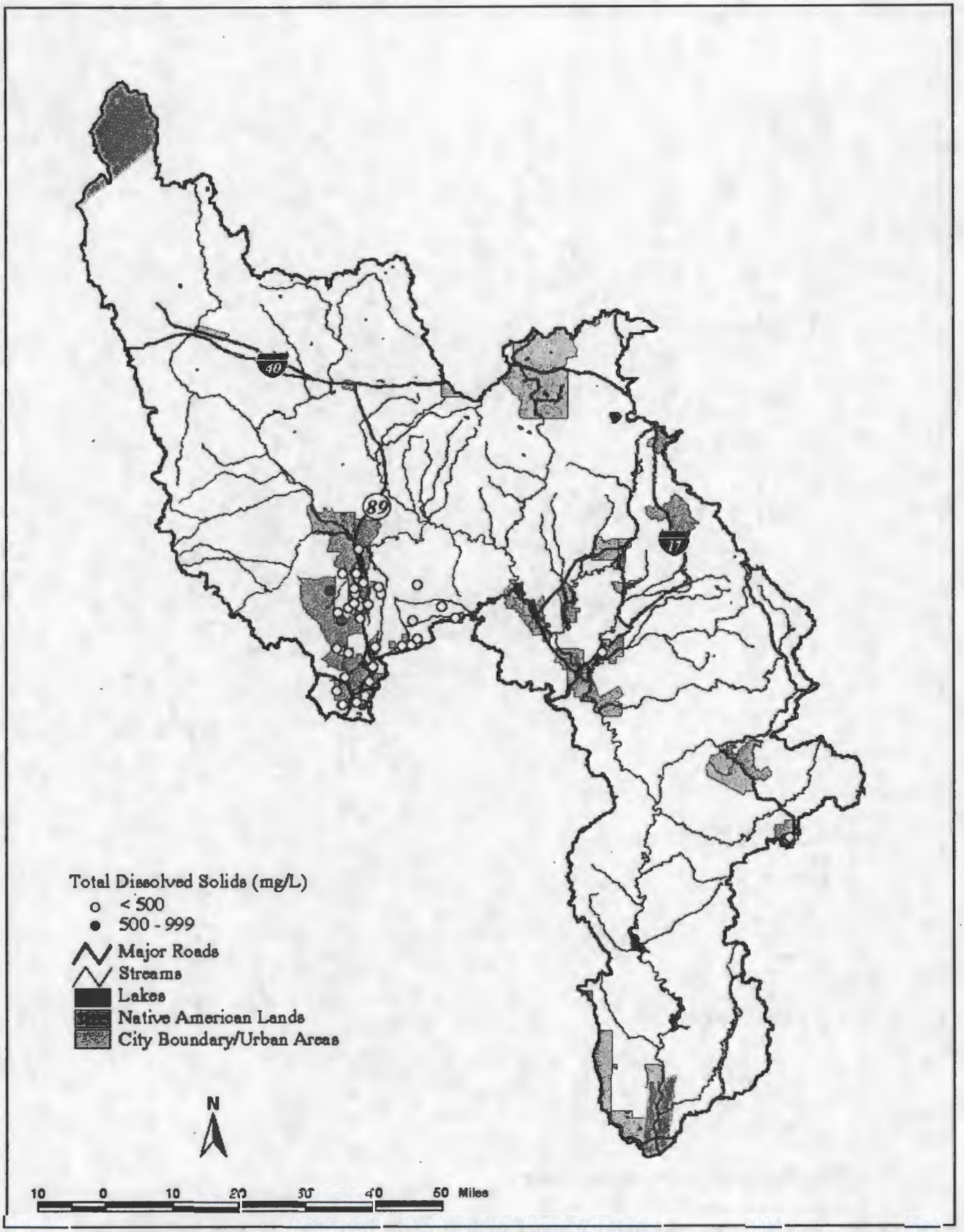

Figure 61. Classification of Ground Water Quality by TDS Concentration in the Verde Watershed

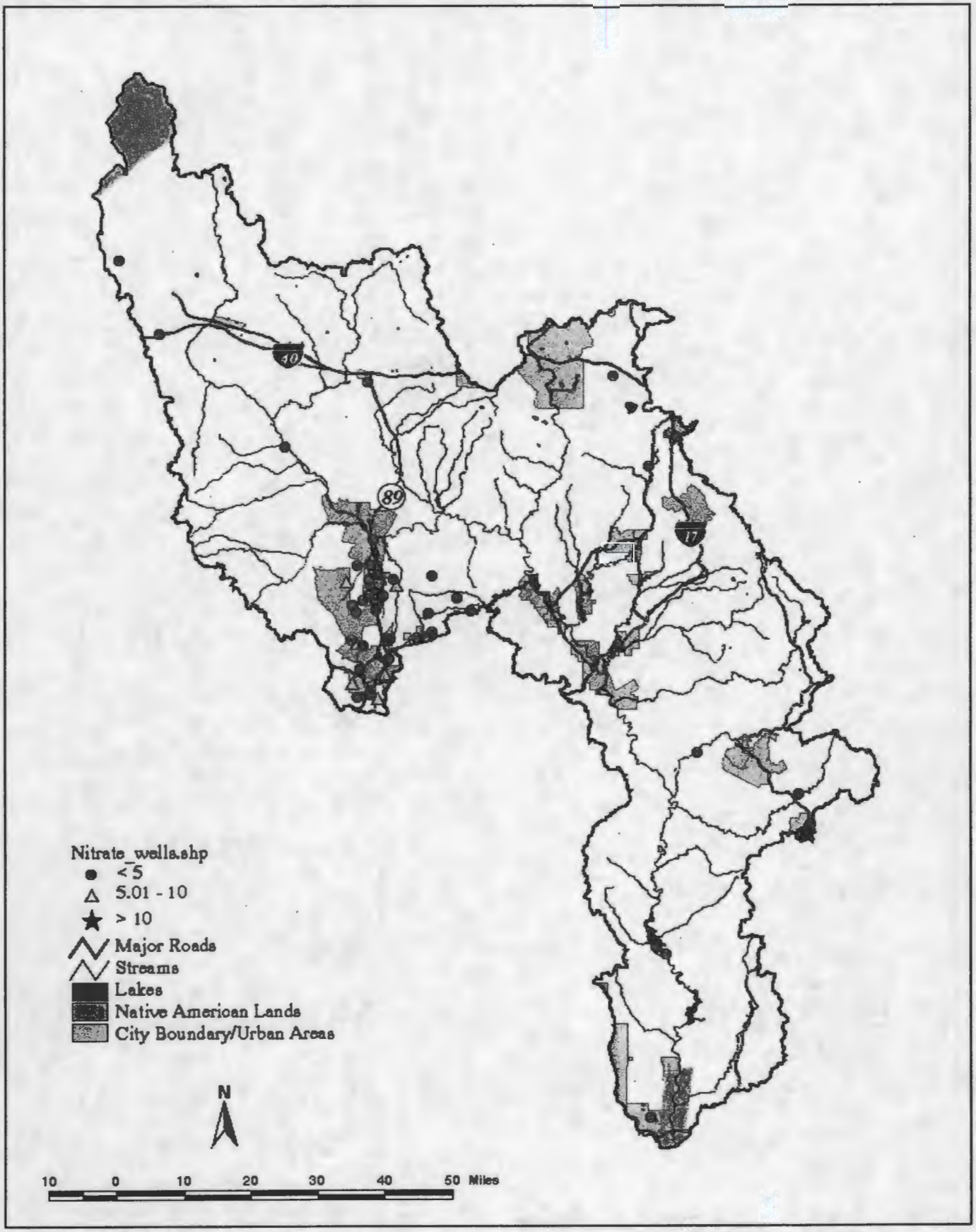

Figure 62. Classification of Ground Water Quality by Nitrate Concentration in the Verde Watershed

Surface Water Studies and Mitigation Projects

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the Verde Watershed. Watershed partnerships active in this watershed are also described.

Total Maximum Daily Load Analyses – The following TMDL analyses have been completed or are ongoing in this watershed. Further information about the status of these investigations can be obtained by contacting the TMDL Program Manager at (602) 207-4468, or at ADEQ's web site: http://www.adeq.state.az.us/environ/water/assess.

- Oak Creek and Munds Creek Nutrient TMDL – The total nitrogen and total phosphorus Total Maximum Daily Load originally established in 1987 for Oak Creek was recalculated by ADEQ, at the community's request. This TMDL was extended to include Munds Creek, a tributary to Oak Creek on the 1998 303(d) List due to nutrients and bacterial contamination. The recalculated TMDL used more sophisticated simulation models that included allowances for non-point sources. It was approved by EPA in 1999.

  Oak Creek flows approximately 21 miles, with a 464 square mile drainage area, dropping 2500 feet through a steep walled canyon in the upper reaches to more gently rolling hills and plateaus in the lower reaches. Oak Creek and the West Fork of Oak Creek are classified as Unique Waters, subject to more stringent antidegradation protection and surface water standards. Munds Creek, one of several perennial tributaries to Oak Creek, does not share this Unique Waters status.

  The Total Maximum Daily Loads for nitrogen and phosphorus in the Oak Creek and Munds Creek are:

  - Total Nitrogen = 440 kilograms/day (67 from point sources, 365 from nonpoint sources, and 8 as a margin of safety)
  - Phosphorus TMDL = 58 kg/day (13 from point sources, 43 from nonpoint sources, and 2 as a margin of safety)

  The primary conclusions and recommendations included in the 1999 nutrient TMDL included:

  - Existing monitoring data and watershed simulation of conditions in the Oak Creek system over a five-year period suggest that few nutrient standards violations occur;
  - Modeling results do not indicate a need to alter existing NPDES permit discharge limits;
  - ADEQ interprets that the surface water quality Antidegradation Rule (R18-11-107) for Unique Waters (Oak Creek and West Fork of Oak Creek) to mean no new or additional loading sources for Oak Creek, nor for any tributaries if the tributary loads affect Oak Creek;
  - No new nutrient limits need to be set for septic system loadings (these were simulated as point source loadings due to modeling constraints); however, special studies of septic system efficiencies and recreational impacts should be conducted; and
  - Oak Creek's status as a Unique Water requires a comprehensive water quality and hydrologic monitoring program of sites on the creek, major tributaries, and major springs and other ground water sources. This also includes working with the Oak Creek Flood Warning System to improve its precipitation gage network and data management system. ADEQ does not have the resources to conduct this type of monitoring by itself and encourages stakeholders to coordinate with monitoring agencies and seek grants to pay for such monitoring.

- Slide Rock Pathogen TMDL – The swimming area in Slide Rock State Park on Oak Creek has experience seasonal exceedances of bacterial standards since the late 1960s. In 1996, the Arizona State Parks Service began daily testing of *Escherchia coli* at Slide Rock State Park to determine when standards are being exceeded and subsequently close the swimming area to protect the public health.

  A study completed in 1998 by ADEQ established that a significant sediment reservoir of bacteria becomes suspended as a result of

recreation pressure and storm events. No point sources discharge upstream of Slide Rock. Possible nonpoint source contributions include recreation, improper waste disposal, septic system seepage, and storm water runoff. Attempts were made to identify whether the bacteria were originally human, domestic animal, or wildlife through DNA genotyping.

Given the uncertainties inherent in the overwintering and regrowth phenomena of the bacteria and the relationship of sediment to water fecal coliform, a phase approach to load reductions is needed to meet standards. An implementation plan is being created to meet the following TMDL allocation:

- 30% reduction of sediment fecal coliform (i.e., reduction in summer sediment fecal coliform values to below 1,160,000 CFU/100 ml) , and
  No exceedances of the single sample maximum *Escherchia coli* standard (580 CFU/100 ml) by 2002.

  Or if *Escherchia coli* standard is not met by 2002, the TMDL automatically is amended to the same 30% reduction in sediment fecal coliform values and meet the single sample maximum standard by 2005.

Source reduction, coupled with Slide Rock State Park management practices are intended to ensure protection of public health at the park. The goal is to totally avoid swimming or full body contact exposure when *Escherchia coli* is at or above the single sample maximum.

- Pecks Lake pH and Dissolved Oxygen TMDL – A TMDL was completed by Tetra Tech, Inc. for ADEQ and approved by EPA in 2000. Pecks Lake, a 95 acre oxbow remnant of the Verde River, was impaired by two stressors: pH and dissolved oxygen. This TMDL focused on nutrient loading to Peck's Lake, as plant and algal productivity were tied to biological oxygen demand, availability of dissolved oxygen, and elevated pH. Nutrient loadings were also a concern as the area surrounding the lake is being developed as a residential area with 900 residences, a golf course, and commercial property.

The TMDL investigation showed that the occasional pH values that exceed the surface water standard and seasonal decreases in dissolved oxygen below the standard are primarily due to the effects of weed growth (macrophytes) on Peck's Lake water quality. At times macrophytes cover about 90 percent of the lake surface and play a major role in nutrient cycling and water quality processes in the lake. Internal nutrient cycling within the lake has resulted in the buildup and breakdown of aquatic vegetation resulting in dissolved oxygen, pH, and narrative nutrient standard violations.

TMDL allocations call for a "no net gain" in external nutrient loading to Peck's Lake. Internal nutrient loadings of both total phosphorus and total nitrogen need to be reduced 25% through harvesting of aquatic macrophytes and other methods. The Total Maximum Daily Load for nutrients were calculated to be:

Total Nitrogen – 74.4 pounds per day
Total Phosphorus – 11.15 pounds per day

This loading was distributed between the following sources, with an allocation reserved for margin of safety: natural background, development, and in-lake. If the existing passive flow through the lake is determined to not be sufficient during the first 5-year phase of this TMDL, additional aeration devises may be necessary.

TMDL implementation will include various strategies to minimize input from runoff and reduce internal nutrient cycling. A comprehensive and detailed monitoring plan has also been incorporated into the Storm Water Pollution Prevention Plan for the Verde Valley Ranch development.

- Stoneman Lake TMDLs – In 2001, EPA approved dissolved oxygen, pH, and narrative nutrient TMDLs on Stoneman Lake. The TMDL was completed by Malcolm Pirnie under contract with ADEQ. Stoneman Lake is a 120-acre natural lake with a 900 acre watershed primarily of pine forest. A 70-home development is on the eastern side of the lake. The lake is relatively shallow (less than 10 feet deep), has no surface water outlet, and is designated as a cold water fishery. The lake has historically experienced an abundant growth of submerge aquatic vegetation during the warm weather months.

Generally a TMDL is allocated for critical hydrologic conditions. For Stoneman Lake this would be the lake going dry, as water quality in Stoneman lake will actually be best during wet years. Because of the impracticality of developing a TMDL for a dry lake, the TMDL was calculated for average hydrologic conditions. Within this context, the most critical season is the summer, with high temperatures and peak macrophyte growth.

The nutrient Total Maximum Daily Loads for Stoneman Lake were determined to be:

- Total Nitrogen – 2,057 grams per day (40% precipitation, 28% runoff and ground water recharge, 32% septic systems)
- Total Phosphorus – 676 grams per day (30% precipitation, 40% runoff/ground water recharge, 15% septic systems)

Dissolved oxygen standards should be met by the implementation of these nutrient loads as they are predicted to cause a 35% reduction in Biological Oxygen Demand over the growing season (from 11.9 to 7.7 mg/liter per day). Summer pH are also predicted to attain surface water quality standards based on the predicted 35% reduction in biomass density (from 410 to 258 grams of dry weight per cubic meter) with the implementation of this nutrient TMDL. Monitoring may demonstrate a need to create a site-specific seasonal pH criterion, as high natural pH is characteristic of shallow, high elevation lakes in Arizona.

The Stoneman Lake TMDL suggested and compared the costs and benefits of seven alternatives to bringing about the necessary reduction in loads. Of the seven alternatives, one is predicted to provide significant water quality benefits at a moderate cost: reopen a ditch to increase water flow into the lake by one-third, thereby helping to maintain higher average lake levels. However, reopening the CCC ditch will likely take 2-3 years, if it occurs. Meantime, increased monitoring will better define expectations for the system in the absence of the ditch water, and if the ditch cannot be reopened, this new data will be used to evaluate the need to set site-specific standards for pH, dissolved oxygen and narrative nutrients or revise designated uses.

- Verde River Turbidity TMDL – ADEQ has submitted a turbidity TMDL for the Verde River to EPA for approval. The Verde River is a perennial stream approximately 156 miles long. Three segments of the Verde River are listed as impaired due to turbidity in the upper section of this river between Perkinsville and Camp Verde.

A massive sampling effort was undertaken in October and December of 1999, collecting one hundred and eighty turbidity readings from above Perkinsville to Camp Verde. All turbidity values observed were below the 50 NTU Aquatic and Wildlife warm-water standard; however, these turbidity readings were taken during relatively low flows and not following a storm event. Natural levels for sediment are believed to be significant inputs into the Verde River, but have been accelerated due to anthropogenic influences.

Load allocations and reduction targets were identified in the TMDL. Turbidity impairment appears to be directly correlated to large storm events, and no load reduction is necessary during average base flow conditions (when exceedances do not occur). The Target Load Capacity for the Verde River during the critical storm flows was calculated to be 731,793 pounds per day as Total Suspended Solids (TSS), while the measured load was estimated to be 964,694 pounds per day as TSS. Therefore the Load Reduction necessary is the difference: 232,901 pounds per day as TSS.

A variety of Best Management Practices have been identified as part of the implementation plan to reduce sediment loading to the Verde River. Some of the implementation strategies include:

- Improve livestock management practices within the Verde Watershed.
- Designate off-highway vehicle areas and employ Best Management Practices at these sites. Enforce off-road travel regulations, educate the public, and close or obliterate unneeded roads.
- Reduce impacts from dispersed recreation through implementation of the "Red Rock Passport," a comprehensive recreation plan for the Sedona area. Recreational opportunities have been limited on some heavily used areas to help reduce soil compaction and erosion from these activities.
- Grassland restoration projects have been implemented to reduce pinyon and juniper densities and increase vegetative

ground cover. This should increase infiltration and reduce soil erosion.

- The US Forest Service, Verde Watershed Association, and Verde Natural Resources Conservation District continue to sponsor educational opportunities and public involvement in decisions regarding long-term management of this resource.
- The US Forest Service, Verde River Greenway and the Nature Conservancy have been acquiring land adjacent to the Verde River through land exchanges and purchasing to reduce development in the active flood plain.
- Prescribed fire treatments are being implemented to reduce adverse watershed effects from uncontrolled wildfire.
- Maintenance and modifications to silted in water catchment structures (such as cattle tanks and Sullivan Lake Dam) will reduce the amounts of fine sediments being brought into the river system.

It may take at least 10 years to see the effectiveness of implemented TMDL strategies. US EPA recognizes that sediment TMDLs with primarily non-point sources of pollution can be difficult to manage, and that these problems have been created over generations and may require as long to correct.

- Beaver Creek and Wet Beaver Creek TMDL Studies – ADEQ collected samples and investigated potential sources of turbidity on Beaver and Wet Beaver creeks and low dissolved oxygen on Beaver Creek in 1999-2000. The low dissolved oxygen was determined to be naturally occurring due to ground water upwelling, as ground water naturally contains very low levels of dissolved oxygen. No turbidity exceedances occurred on Wet Beaver Creek out of 11 samples. Based on these investigations, ADEQ is recommending delisting Beaver Creek for low dissolved oxygen and Wet Beaver Creek for turbidity.

  However, the turbidity TMDL investigation of sources and loadings is ongoing in Beaver Creek. ADEQ is currently working with the US Forest Service to look at recent and potential improvements in rangeland and recreation management in this drainage area.

Draft Verde River Assimilative Capacity Data Summary Report – Significant population growth is projected for some portions of the Verde Watershed, and this growth will increase the nutrient loads from runoff, septic systems, and proposed new or expanded waste water discharges.

ADEQ contracted with Tetra Tech, Inc. to provide technical support for an assimilative capacity study. If the assimilative capacity of the river is anticipated to be exceeded with the addition of the proposed new point sources and secondary impacts from increased population, a Total Maximum Daily Load (TMDL) will need to be developed to allocate the available assimilative capacity and ensure that the river continues to support its designated uses. This data summary report catalogues, evaluates, and assesses the existing data and information about nutrient loadings in the Verde River. This will provide the information needed to select an appropriate water quality model. This report provides a summary of existing sources of data, standards, potential sources of nutrient loads in the watershed, a possible conceptual model, and remaining data gaps.

Water Quality Improvement Grants – ADEQ awarded the following Water Quality Improvement Grants in this watershed:

- Northern Arizona University On-site Wastewater Demonstration Project – This on-going project began in 1997. This project involves the construction of four different alternative on-site wastewater treatment technologies on the Norther Arizona University campus using married student housing wastewater effluent. The treatment options are linked to a system that controls operations and monitors and relays wastewater treatment parameters.

  The project utilizes the teaching and student staff of the Civil Engineering Department. Training for on-site professionals is conducted at the demonstration site and the teaching pavilion as well as at alternate locations such as Maricopa and Pima County. The project will demonstrate the design and treatment options of site conditions typical to northern Arizona which are challenging situations of shallow clay soils over rock Research and product approval options are also available at the site.

- Oak Creek Pollution Prevention Project – The project addresses the bacterial contamination in Oak Creek that may be contributed by failing septic system (see prior discussion of Oak Creek's pathogen TMDL). In 1998, Coconino County received funds to partner with property owners and upgrade 8-10 existing failed or substandard on-site wastewater treatment systems along Oak Creek. The project will monitor and evaluate the performance of these installations for one year.

  The project also has a strong community education outreach component to increase the knowledge and cooperation of the public regarding on-site wastewater treatment and pollution prevention using a website, workshops, and formation of a Technical Advisory Committee for wastewater permitting issues.

- Northern Arizona University Oak Creek Sampling and *Escherichia coli* DNA Genotyping Project – Under the direction of the NAU Department of Environmental Microbiology, *Escherichia coli* samples were collected in water and sediment at five sites along Oak Creek Canyon. This study was designed to further characterize the existing bacterial problem in Oak Creek Canyon (see Slide Rock pathogen TMDL study above). Fecal material from potential mammal populations in the sub-watershed were also sampled to develop *Escherichia coli* genotypes. The report identifies the type and relative proportion of fecal pollution in Cak Creek, identifying contributions from human, cattle, dog, elk, deer, horse, mountain lion, racoon skunk beaver, antelope, bear and llama.

- Oak Creek Water Quality Guardian Project – This project is a cooperative effort with local property owners (homeowner associations), Coconino County Environmental Health Department and Groundwater Guardian affiliates to upgrade up to 10 old and potentially failing on-site septic systems from along high risk or susceptible area along Oak Creek. (See Oak Creek nutrient TMDL and Slide Rock pathogen TMDL described above.) The project principal, Canyon Services, has also mapped some of the areas' susceptible and challenging soil conditions. After upgrades are completed, the systems will be monitored for bacteria and phosphorus.

- Oak Creek Water Quality Guardian Sediment Project – In 1999, Circle C Engineering received funds to evaluate the effectiveness of using sediment traps in reducing bacterial pollution in Oak Creek (see Slide Rock pathogen TMDL). Erosion control sediment traps were placed at four strategic locations and monitored during storm events to provide data about transportation of fecal material in Oak Creek and the effectiveness of sediment traps. The project is a cooperative effort between Forest Service, State Parks, and citizens.

- Stoneman Lake Sediment Project – Circle C Engineering, a Groundwater Guardian affiliate, was awarded funds to upgrade septic systems, address grey water disposal, and provide sediment traps. A Groundwater Guardian newsletter was published to educate the public on the grant objectives and opportunities to participate in the seven septic upgrades and grey water systems. Monitoring for nitrate and orthophosphate will occur below the sediment traps and in washes and culverts during storm events to assess incoming loads to the lake. (See Stoneman Lake TMDL discussed above.)

- Cornville Watershed Project – A grant was awarded to the Yavapai County Flood Control District and local residents to revegetate a storm water detention pond using solar power to establish native grasses and shrubs to reduce sediment causing turbidity in Oak Creek. The project also used cattle to restabilize erosion gullies at the pond site. The site will be used for educational programs with local schools, and nearby Cornville Park. Workshops, educational materials, website and news releases are part of a strong community outreach component of this project.

Water Protection Fund Projects – The following projects received Water Protection Funds from the Arizona Department of Water Resources:

- Stable Isotope Assessment of Ground and Surface Water Interaction Between Chino Valley and the Verde River – Arizona State University was awarded funds to sample surface and ground water in the Chino Valley, and to analyzed the waters for naturally occurring stable isotopes of hydrogen and oxygen. The main goal of the study was to determine if a hydraulic connection exists between the aquifers of the Chino Valley and the Verde River. This information would assist in determining the effects, if any, of ground water pumping within the Chino Valley on the flow in the upper Verde River. The study was completed in 1997.

- Sycamore Creek Riparian Management Area Project – The Tonto National Forest was funded to restore and protect a 19-mile reach of Sycamore Creek (a major tributary of the Verde River) from uncontrolled livestock grazing and off-road vehicle use. To stop further damage to the creek from uncontrolled livestock grazing and off-road vehicle use, 15 miles of fence were constructed to enclose the riparian corridor. The objective is to increase the canopy cover and density of riparian vegetation within the corridor. The project was completed in 1999.

- Road Reclamation to Improve Riparian Habitat Along the Hassayampa and Verde Rivers – The Prescott National Forest received a grant for a three-year project that should result in closure and revegetation of almost 20 miles of roads adjacent to the Hassayampa and Verde rivers. The goal of the project is to reduce erosion and sedimentation into the rivers, restore riparian and upland vegetation on the closed and reclaimed road surfaces, and eliminate unauthorized roads. The project was completed in 1999.

- Riparian Habitat Restoration Along a Perennial Reach of a Verde River Tributary – Northern Arizona University received funds for a three-year project to restore habitat critical to the successful regeneration of a Bebb willow-mixed graminoid riparian plant community. The project site is in the area of Hart Prairie (northwest of Flagstaff) on a tributary to Sycamore Creek. The project involves removing an existing surface water diversion, restoring the natural drainage channel, fencing critical areas, and monitoring vegetation response to hydrologic changes. The project was completed in 1999.

- Restoration of Fossil Creek Riparian Ecosystem – Rocky Mountain Research Station in Flagstaff was awarded a grant to determine the potential effects that a proposed reestablishment of part or all of the presently diverted flows of Fossil Creek could have on reestablishing riparian vegetation along the stream's corridor. The project was to compare and contrast historical vegetation with present vegetation to determine the consequences of adding additional water into the creek. The stream has been de-watered for almost 80 years by the diversions for hydroelectric use, but may receive some of all of this water within the next few years. The project was completed in 1999.

- Watson Woods Vegetation Inventory – The Prescott Creeks Preservation Association completed a vegetation inventory of Watson Woods in 1998. This inventory characterized the vegetative communities within the Watson Woods Preserve in order to describe baseline conditions at the site. This information will guide management and restoration efforts at the preserve.

- Upper Verde Adaptive Management Unit – The Almida Land and Cattle Company was awarded a Watershed Protection Grant to maintain the continued health of riparian habitat along the Verde River. The company is to develop a livestock grazing system that excludes cattle from replacement facilities uplands. To achieve this, the grantee will build six miles of four-strand barbed wire fencing, construct seven miles of underground pipeline, install twelve drinkers, and two 20,000 gallon storage tanks. The project is to be completed in 2002.

- Verde Riparian Action Plan – The Verde Natural Resources Conservation District (NRCD) was awarded a three-year grant to dig trenches and holes for planting cottonwood and willow trees along the Verde River and its perennial tributaries. Since 1991, the Verde NRCD has maintained a riparian species nursery and each year trees are harvested and sold or planted. This project will support the NRCD Riparian Species Planting Program efforts to restore riparian habitat of the Verde River.

- Horseshoe Allotment: Verde Riparian Project II – George and Sharon Yard, who ranch on U.S. Forest Service land along the Verde River, were awarded a Watershed Protection Grant to create an off-river pasture through development of a currently dry pasture. This goal is to improve 3.75 miles of the Verde River by constructing pasture division fencing, river fencing, and a waterline for five cattle drinkers, three small wildlife drinkers, and two storage tanks. The project is to be completed in 2001.

- Upper Verde Valley Riparian Area Historical Analysis – Northern Arizona University (NAU) received funds to compare the historical riparian system of a seven-mile reach along the Verde River, with the current system to determine what changes have occurred in riparian vegetation. The grantee assessed the relationships between vegetation changes and climatic factors, human land use activities and varying

ground water levels to determine which vegetation changes were caused by human activities in the watershed. Based on the results of this study, NAU made recommendations for preservation, restoration, and enhancement of riparian habitat. The project was completed in 2001.

- Verde River Headwaters Riparian Restoration Demonstration Project -- Northern Arizona University received funds to restore the channel and riparian vegetation along 2600 feet of a perennial stream that flows in Clover Springs Valley. The proposed restoration area is located in the Coconino National Forest about 5.5 miles south of Clint's Well on Highway 87. Specific project objectives include:
  - Develop and implement a channel stabilization and wetland protection plan for the Clover Springs reach. This will include removal of existing channel structures, reshaping and redirecting the channel and use of low impact structures to encourage natural channel stability;
  - Determine the causative factors and timing of aggradation and incision in this reach through investigation of past flood plain activity, radiocarbon dating and description of sediments, tree ring dating and historic photos;
  - Develop an information kiosk or signs at the site to explain the role of meadow ecosystems, historic disturbances, current conditions, desired conditions, and restoration techniques.

- Effects of Livestock Use on Riparian Trees on the Verde River – Arizona State University is to study how various livestock use levels affect growth, survival and population dynamics of Goodding Willow and Fremont Cottonwood trees along the Verde River. Under the terms of a Biological Opinion for the Skeleton Ridge Allotment, no more that 40 percent of the meristems of these woody species may be used for grazing. This standard has been adopted by the Tonto National Forest for riparian areas with federally listed species. Anecdotal information supports this level of use but little quantitative data exists to support this standard. The project is to be completed in 2003.

Rocky Mountain Research Station Verde River Watershed Research – The US Forest Service Rocky Mountain Research Station has been conducting research in or adjacent to the Verde River Watershed since establishment of the Fort Valley Experimental Forest in 1908. Twenty drainage areas were instrumented with stream gauges, precipitation gages, and other equipment. Over 700 publications have been produced from the Beaver Creek Project alone. Since 1993, research has focused on the upper Verde River and Fossil Creek, looking at fish populations, riparian vegetation, water quality, and channel geomorphology. Some of their most recent reports include:

- A Preliminary Analysis of Riparian Habitat Conditions of the Upper Verde River (Medina, 2001) – Several vegetation and channel surveys were conducted in 1997, 1998, and 2000 in the upper Verde River. The study site is limited to the reach between Sullivan Dan and Tapco, the eastern boundary of the Chino Ranger District. The preliminary results of these studies are presented with special emphasis on stream bank herbaceous and woody vegetation and channel conditions that might influence spikedace. The plant communities described are those found on the streambanks and not totally inclusive of the entire riparian zone. Several influences capable of affecting the functional condition of riparian habitats are discussed including channel maintenance, exotic vegetation, grazing effects, and channel conditions.

- A Preliminary View of Water Quality Conditions of the Upper Verde River (Medina, 2001) – In 2000, two water quality monitoring stations were installed in the upper Verde River for the purpose of monitoring common parameters such as temperature, turbidity, conductivity, pH, dissolved oxygen, and suspended sediments. The preliminary results of one year of study are reported in this paper and contrasted with data from previous surveys.
- Base Flow Trends and Native Fish in the Upper Verde River (Neary and Rinne, 2001) – Although much attention has been given to the effects of storm flows on native fish in Arizona's rivers, the minimum base flows are the most critical for fish survival. Because of the controversy over threatened and endangered fish such as the spikedace (*Meda fulgida*) in the upper Verde River, it is important to examine the recent trends in minimum base flows on this river which supports a native fish community. Base flow and trends are reported.

- Role of Verde River Reservoirs on Water Quality: from Arsenic to Algae (Westerhoff et al., 2001) -- Variable climatic patterns and scheduling of reservoir releases along the Verde River impacts water quality in Horseshoe and Bartlett reservoirs, which serve as approximately one-third of the drinking water supply for the

metropolitan Phoenix area. Data collected over the past five years along the Verde River from the confluence of Tangle Creek to the confluence with the Salt River was used to assess the impact of water quality in the Verde River on downstream potable drinking water facilities. The database includes arsenic, organic carbon, plus total and dissolved nitrogen and phosphorus in the Verde River and Bartlett Reservoir. In addition the database includes information on the algae occurrence in the reservoir, and the seasonal concentrations of algae-produced taste and odor compounds. This paper discusses how water quality in the Verde River impacts downstream potable water treatment plants in terms of meeting tightening drinking water regulations and providing water that does not have un-aesthetic tastes or odors.

Watershed Condition Assessment for Select Verde River 5th Code Watersheds – The Prescott National Forest assessed the watershed condition of lands from Big Chino Wash to Childs on the west side of the Verde River. The watershed assessment focused on three resource components: aquatic, riparian and soil conditions within the watershed, and related this information to designate critical habitat for spikedace (*Meda fulgida*) and loach minnow (*Rhinichthys cobitis*), two native threatened fish species. The aquatic assessment included information on water quality, macroinvertebrates, fisheries habitat, and geomorphology of the river.

Verde River Corridor Project – The Verde River Corridor Project began in the fall of 1989 as a locally directed effort, sponsored by the Arizona State Parks Stream and Wetland Program, with the goals of examining all the uses and values of the Verde River corridor. The study area covers the middle stretch of the Verde River which extends approximately 55 to 60 river miles, from TAPCO (north of Clarkdale) to Beasley Flat (south of Camp Verde). The mission of the project was to identify and recognize all uses of the Verde River corridor, encourage protection of the Verde River and its natural and cultural resources, and promote coordinated decision making for the continued enjoyment and use of the Verde River by future generations.

Ground Water Studies and Mitigation Projects

Prescott Active Management Area Baseline Study – The Prescott Active Management Area is 485 square miles, with the northern half in the Verde Watershed and the southern half in the Middle Gila Watershed. See discussion of this study in the Middle Gila Watershed section.

Federal and state Superfund cleanup sites – Three Superfund and Department of Defense cleanup sites are located in this watershed.

- Camp Navajo – Camp Navajo (previously Navajo Depot Activity), is a WQARF site located in Bellemont, Arizona, 12 miles west of Flagstaff and 17 miles east of Williams, Arizona. This 28,347 acres facility includes 776 igloo structures for storage of conventional (and formerly chemical) munitions. There is a demolition area in the southern portion and buffer zones along the eastern and western borders of the base. Contaminants of concern include heavy metals, volatile and semi-volatile organic compounds, pesticides, and constituents of explosives.

  The entire site is still in the remedial investigation phase, with ADEQ collecting soil, surface water, and ground water samples to determine the extent of contamination. The unexploded ordinance located on the surface of the open burning-open detonation range is of concern. ADEQ and the Army have agreed that surface clearance will be performed while the remedial investigation continues.

- Payson PCE site – In 1990, the discovery of tetrachloroethene (PCE), a solvent commonly used in dry-cleaning, in two unused Payson municipal wells caused the initial investigations at the WQARF site. ADEQ investigations found that PCE had impacted a number of private wells in the immediate vicinity.

  ADEQ and the town of Payson have taken precautions to prevent public exposure to the contamination. The Arizona Department of Health Services developed a "Statement of Risk" to identify risks associated with consumption of water from contaminated private wells in the area. Although most of the private wells were contaminated at levels below the drinking water standard established to protect human health (5 µg/L), well owners were advised to not drink the water and that ADEQ would provide a temporary supply of bottled water until the owners could secure an alternative supply. Continuing tests indicate that the town of Payson municipal water supply has not been affected by the PCE.

- Tonto and Cherry Streets in Payson site – The Tonto and Cherry WQARF site in Payson is 400 feet west of the Beeline Highway and immediately north of Frontier Street. Tetrachloroethene (PCE) has been

detected in three private drinking water and three ground water monitoring wells at the site. PCE concentrations in the private wells exceed the drinking water standard; therefore, bottled drinking water is being provided to these private well owners on a temporary basis. A fact sheet was mailed to all of the residents and businesses within the community involvement area and in December 2000, the Tonto and Cherry community advisory board (CAB) combined with the existing Payson PCE Community Advisory Board.

In February 2001, ADEQ completed the installation of three ground water monitoring wells near Tonto and Cherry Streets. Due to ground water information obtained during drilling and sampling, ADEQ decided not to install extraction wells at Tonto and Cherry at this time. However, ADEQ will continue to conduct monthly ground water measurements and quarterly ground water quality sampling at the site.

Watershed Partnerships

Verde Watershed Association -- The Verde Watershed Association was formally organized in 1993. The association is made up of concerned citizens from the community, users of the Verde watershed resources, and local, state and federal agencies. Members identified key issues, and are identifying sources of water and the real and potential threats of pollution to these waters. In addition, the association has initiated and or participated in programs to remedy these concerns. It is important to understand that this is a locally led effort with the role of federal and state governments being that of administrative assistance and technical support. The group meets monthly in Cottonwood, Arizona.

The Verde Watershed Association publishes the monthly newsletter *Verde Currents* (formerly *Confluence*) which is available on its website. The association has developed a Watershed Restoration Action Strategy which is also available on their website: http: // www.vwa.southwest-water.org.

Oak Creek Task Force – The Oak Creek Task Force is an organization of agencies and concerned citizens. Agencies actively involved in the Oak Creek Task force are: Arizona State Parks, US Forest Service, City of Sedona, Arizona Department of Water Resources, Northern Arizona University, Coconino County and Arizona Department of Environmental Quality. The group is actively involved in grant projects and public outreach to maintain and protect the Unique Water status of the beautiful and very popular Oak Creek Canyon. The Task Force has a draft Watershed Restoration Action Strategy (WRAS) targeted to be finalized in fall of 2001. Information about meetings can be obtained from Co-chairmen: Barry Allan, (602) 953-1291 and Morgan Stine, (520) 282-1101.

Verde River Alliance – This citizen initiative advocacy group is in its formative stages following workshops developed with the assistance of the Nature Conservancy. As of this writing, the group has a newly elected steering committee of six members and draft mission statement and objectives. Information about this group's activities can be obtained at the following e-mail address vrca@verdenet.com.

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